

... BUT THE JOKE WAS ON HIM! ... by Timm'as

THESE LIFEBUDY ADS.
AMUSE HE, I ALWAYS
READ THEM -- BUT I
CAN'T BELIEVE SO MANY
PEOPLE HAVE "B.C."

YOU'RE WRONG, "B.O."
IS A COMMON FAULT
AND CAN WRECK A
MAN'S HAPPINESS, I KNOW



I WAS IN LOVE WITH A
CHARMING GIRL, SHE SEEMED
TO LIKE ME — YET SHE TURNED
ME DOWN. TOO LATE I
DISCOVERED WHY... I HAD BEEN
CARELESS ABOUT B.O."



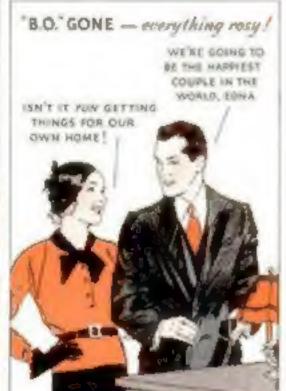
TELL YOU THIS BECAUSE I BON'T WANT YOU TO MAKE THE SAME MISTAKE I DID

YOU NEAN... I'M GUILTY
SONETIMES? THOSE "B.O." ADS.
I LAUGHED AT — IS THE JOKE
ON ME? IS THAT WHY EDNA
IS OFTEN SO COOL TO ME?



MY ADVICE IS - PLAY
SAFE WITH BO TO
CHANGE TO LIFEBURY





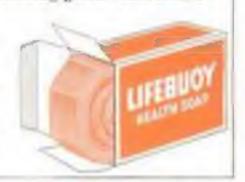
Get the facts STRAIGHT about "B.O."

Every normal person perspires. Pores give off a quart of odor-causing wasse daily. Stuffy, overheated rooms increase the danger of offending. Play safe—bathe regularly with Lifebuoy. Its pleasant, quickly-vanishing bygienic scent tells you, "Here is no ordinary toiler soap!" Lifebuoy gives extra protection. Its creamy, abandant, pencerating lather putifies and distances pores—effectively stops "B.O." (bidy adm). Helps protect health by removing germs from hands.

Great for the skin

Massage Lifebuoy's bland, creamy lather well into the pores; then rinse. Do this nightly. Watch your skin clear and freshen—glow with new health! Adopt Lifebuoy today.

APRODUCE OF LEVER REOTHERIOD.



A TIP FOR SHAVERS







LIFE BUOY SEND FOR A TUBE TUBE TUBE

This new lather holds 52% more moisture!

Soaks beard extra sift - souther skin - gives smoother, easier shaves

Man, you can't expect snything but rough, sporty shaves with light, quick-drying lather. But, by laboratory tens, Lifebooy Shaving Cream lather holds 52% more moisture. It make wiry whiskers extra soft—the razor

whisks them off in a july—you get the smoothest, cleanest share ever, Lifebuoy soothes, protects the skin. Economical, too, a little makes to much lather. Get it at your druggist's. Or write for a free trial tube to Lever Bros. Co., Dept. A142, Cambridge, Man. [Thursfer good in U.S. and Canadaenty]

Look Under the Paint when you Look at All Three



Floating Power is one reason they're calling Plymouth Six_ America's next Number One car!

You mechanically-minded men are particular about good looks in a car! But you want a lot more!

So you're just the men we like to talk to about the new Plymouth Siz. You know what it means to have a 70horsepower, six-cylinder motor in a car of this size!

You understand the value of Floating Power engine mountings—the value of mounting an engine on rubber and steel at two points instead of four! So it can rock gently on its axis . . . without fighting the frame!

You know the hydraulic principle—and how well it works in brakes. You know what makes a car safe. So

you like Plymouth's safety-steel body, its rigid-X frame, its safety-glass windshield! We like you men to "Look at All Three"—because you're picking Plymouth!

IT'S A SIX AT \$60 LESS THAN LAST YEAR

Business Coups \$495, Rumble Seat Coupe \$545, 4-Door Sedan \$575, Conventible Coupe \$595; all prices f. o. b. factory. Convenient time-payments. Free-wheeling, rigid-X frame, easy-shift transmission. Automatic Clutch optional — \$8.

PLYMOUTH SIX

SOLD BY 7,232 DESOTO, DODGE AND CHRYSLER DEALERS EVERYWHERE

Copyrighted missions

RAYMOND J. BROWN, Editor
ARTHUR WARELING, Home Workshop Editor
ALDEN P. ARMAGNAC, Associate Editor
Sydney Oxberry, Art Editor

POPULAR

VOLUME 122 · NUMBER 2

15 Cents a Copy · \$1.50 a Year

Published Monthly by

Popular Science Publishing Co., Inc.,

381 Fourth Ave., New York

TABLE of CONTENTS for FEBRUARY, 1933

First Transatlantic Air Line Links Two Continents	4	4	13
World's Biggest Stage Is Marvel of Mechanics	-1		16
Old Words Get New Meanings in Queer Trade Lingoes Picturesque oddities of modern professional slang translated by GAYLORD JOHNSON			28
Safe Pain-Killing Drugs Bring New Era in Modern Surgery FREDERIC DAMRAU, M. D., tells of wonders wrought by the latest anesthetics	٠		32
Life of Atom Shown in Movies	٠	٠	35
How the Biggest Ship Was Safely Launched			36
Uncle Sam's Secret Agents Save Farmers from Crop Sharks . WALTER E. BURTON discloses the drama behind the Government's produce reporting			38
New Products Hasten Prosperity's Return			40

Popular Science Manually is pulse itshed employ at 1st teach teach. New York, N. Y., by the Popular Science Produced and Treasurers II. C. Villiam York President Rolls Novelle Villiam York President Rolls Science II. C. Villiam York President Rolls Science II. C. Villiam York President Rolls II. C. Villiam York Office II. Control of the Villiam II. Control of President II. C. Villiam II. Control of Printed III. C. P. A. Copyright, 1913, by the Popular Science Publishman Vol. Inc. Sci. Science III. C. Canada, S. Superchiam Inclinition of the States and the Rolls Science III. Sci. Superchiam Inc. Canada, S. Superchiam Inc. Canada, Superchiam Inc. Contribution Inc. Contribution Inc. Canada, Science Monthly does not catal Canada Inc. Canada, Science Monthly sprinters for user's science Monthly sprinters for user's

FEATURES AND DEPARTMENTS

Our Readers Say	10
Microscope Creates New Worlds .	46
Chemicals You Can Make	56
Stunts Illustrate Natural Laws	58
Homemade Test Lamp for Radio	59
Simple Amateur Radio Phone	60
How Detector Helps Radio Work	61
Fixing Faulty Car Brakes	62
The Home Workshop	63
Short Cuts for Car Owners	72
Flashlights Aid Picture-Taking .	78

Cover Design by EDGAR F. WITTMACK

AUTOMOBILES

Cigarette Case for Auto	1.	18
Device Renews Worn Platons		24
A Two-Way Truck	'n	26
Poils the Car Thief	,	42
Tiny Car Has Rubber "Motor	,11	45
Elephant Serves Motorist		49
Car Tested on Rollers		50
New Spack Ping Tool		50
Life-Saver on Big Rus	i	51
Car Tests Three Fuels		SI
50 Instruments Help Run Car	4	53
Dual Voltage Battery	9	53

Strange Motor for New Plane . 19

(Continued on page 4)

How a Man of 40 can Retire in 15 Years THE RETURN TH

I'makes no difference if your carefully laid plans for saving have been upset by the depression. It makes no difference if you are worth half as much today as you were in 1929.

Now, by merely following a simple, definite Retirement Income Plan, you can arrange to quit work forever fifteen pears from today with a monthly income guaranteed to you for life. Not only that, but if something should happen to you before that time, we would pay your wife a monthly income for life. Or, if you should be disabled, and were unable to continue your payments, we would make them for you, and pay you a disability income besides!

*250 a Month beginning at age 55

Suppose you decide to retire on \$250 a month beginning at age 55. Here is what you get:

- 1. A check for \$250 when you reach 55 and a check for \$250 every month thereafter as long as you live.
- 2. A life income for your wife if you die before age 55.
- 3. A monthly disability income for yourself if before retirement age serious illness or accident stops your earning power for good.

It sounds too good to be true. But it isn't. There are no "catches" in it, for the plan is guaranteed by an 80year-old company with \$600,000,000 insurance in force. If you are in good physical trim, and are willing to lay uside a modest portion of your income every month, you can have freedom from money worries and you can have all the joys of recreation or travel when the time comes at which every man wants them most.

The Plan is not limited to men of 40. You may be older or younger. The income is not limited to \$250 a month. It can be more or less. And you can retire at any of the following ages you wish: 55, 60, 65, or 70.

How much does it cost? When we know your exact age, we shall be glad to tell you. In the long run, the Plan will probably cost nothing, because, in most cases, every cent and

more comes back to you at retirement age.

Write your date of birth in the coupon below and mail it today. You will receive, without cost or obligation, a copy of the interesting illustrated booklet shown above. It tells all about the new Phoenix Mutual Retirement Income Plan. Send for your copy of the booklet now. The coupon is for your convenience.

PROPERTY MUTUAL LIFE INSURANCE CO.

The Property Mornal Retreement

The Property Mornal Retreement

Income Plan,

Natur

Date of Birth

Engage

Address



PHOENIX MUTUAL LIFE INSURANCE COMPANY

Home Office: Hartford, Conn.

Established in 1851

P. M. L. I. C.

POPULAR SCIENCE MONTHLY for FEBRUARY, 1933

(Continued from page 2)	Selens Wairl on Snow Plow 24	Dogs Now Naseprinted 42
Navy Gets Two-Purpose Planes 45	This from Can Crawl on Land . 26	Transformer luside Insulator 42
Liquid Air Helps Make Motors 50	Mahile Life Preserver 27	Odd Device Measurus Fre 42
	New Jack Pushes Tree Dawn . 27	Seek Secrets of Frost
ENGINEERING	Sam Curs Off Finger Ring 27	Process Sives Newspapers 45
Change Course of Big River . 22	Cylinder Dives for Treasure 43	New Way to Serve Ice Cream . 45
Model of 1,400-toot Windmill 26	Pipe Shunts Real Bullets 41	Machine Measures Beauty 48
Superhighway Links Ciries 26	Hulder linelases Cigarette 44	His Xylophone Sells Pastry 48
Dishpans Light Work at Dam . 48	Skid Chains for Shoes	Big Fars Protect Orchards 19
Monete	New Bicycla Has Odd Dusigo . 49	Tests Fireproofed Wand 51
MODELS	Polding Pipe for Smokers 50	Guns Clean Comeut Kilms 52
fookstknife Model al Liner 63	Novel Photograph Needle 50	Traps Cosmie Rive in Celler , 52
Scenic Effects for Railway 78	Sight for Archer's Bow , \$2	One Man Handles Big Ladder . 32
Fiber Board Reduces Noise 78	Cellophone Windows S3	Imitation Brick for Houses 53
Telegraph Pole Insulators 78 A Tool-Circuit Rhemstat	Perforated Golf Club	FOR THE HOME OWNER
Making Ship Model Ladders 87	PHOTOGRAPHY	Door Stop from Toberco Can . 56
Armament for Our U.S.S. Texas 88	Dots on Margin Identify Films . To	Setting Ludder Against Pole 67
Ruling Fun Aids Model Making . 95	A Pill-flox Timer	Attaching Tube to Faucet 73
MERS DEVICES FOR	Camera Splits Sport Honors 15	Tightening Hinge Pins
NEW DEVICES FOR THE HOME	Odd Lens Needs No Filter 43	
	Photos "Read" Burned Papers 51	IDEAS FOR THE HANDY
Invisible Gas Hester 54	\$100 for Family Group Photos . 28	MAN
Curter Opens Paper Carrons 51		Rack Holds Metal Stock 50
Portable Bridge Table Si	RADIO	Rused Panels Made on Jig Saw , 66
Automatic Defraster	Heyra-Pound Rad opnom . 18	Clamps Aid in Troing Rods 66
Parlames Dresser Drawers 54	Radio Controls Model Bont 21	Child's Lamp Has Night Light ., 67
Time for the Medicine 51	Edison's Tube Works in Yest 44	Scraping Aquarium Walts , , , 67
Electric Wast Candles Si		Snowshop Making In East 65
Divan and Two Beds in One 35	UNUSUAL FACTS	Organizated Indoor Fountain 70
Touth Pasta Tube Hohler	AND IDEAS	Ritchen Worktable Folds Plat . 75
Columber Part of Stew Pot 55	Looks Like Perpetual Marion . 18	Depth Gage for Circular Say 73
Protects Bridge Table	Gross-Eyes Now Cured by Pie-	Fixings for Your Ice Yacht 80
Ash Tray and Tobacco Holder . SS	tures	Repairing Harness Saves Money 85
Clock without Handa	Blustrated Lectures Given by	Our Construction Kits St
A Blanket of Scopsods SS	Marline 19	Clamping with Pinch Dogs So
NEW PROCESSES AND INVENTIONS	Hagpole Moved at Busy Spot 20 Metal Dishes for Explorer . 20 Making Mariners in College . 23	Hinges Provide Toy Axles Sa Sacting Trax from Fig Packing . Sa
Frame Teaches Swimming 18	Forry Carries One at a Time . 24	HINTS FOR THE
New Indoor Golf Tea 15	Lures Mosquitues to Death 25	MECHANIC
Ryel Part of Fishpole 19	Locomotive Like Box Car 27	Sleeve Supports Taps in Lathe , 73
Theatrical Scenery in Kit 20	Magnet Finds Lost Locomotive , 30	Keyway Cut on Drift Press . 80
Windmill Defea Hurricanas 20	Flowers Grunn for Mayira . 31	Transferring Blind Holes 07
High Speed Railway Busen , . , 21	Proposes Houses of Cotton 42	Holder Keeps Wire Tun 97

In This Issue—Hundreds of Fascinating Articles Tell the Latest News of Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions

"Now

we can advertise it"

Products are nearly always put on the market before they are advertised. Quite frequently, changes have to be made in an article before the public generally will accept it. Color, design, flavor—those are some of the things the public has to be consulted about. Sometimes a product won't sell at all and simply has to be discontinued. As soon as people show that they welcome an article, and as soon as all refinements and improvements have been added, then you could hear the manufacturer say, "Now we can advertise."

When you buy advertised goods, you may know they have gone through the experimental stages. You may be sure that the manufacturer knows they are right and that he is willing to stake his reputation on them. You may be confident that you are buying goods that have sold and that would continue to sell without any advertising at all. For advertising merely lets all of the people know—now—what considerable numbers would find out by word of mouth ten years from now.

Of course, advertising goes a step farther. Word of mouth hardly ever tells all the uses of a product. It often doesn't give the real reasons for its superiority. Advertising tells people all about a product and the numerous ways in which they can use it.

Let the advertisements be your guide. When the manufacturer says, "Now we can advertise it," you know that you can safely say, "Now we can buy it."

MEET OPPORTUNITY

OPPORTUNITY for well-trained people is greater today than ever before; changes are more frequent. Increased especity to assume responsibility is sought, whether it be in the lowliest office job or a high diplomatic mission.

Universities are extending their facilities to meet the demand for practical, as well as for purely cultural aducation.

Columbia University offers home study instruction that resembles private tutoring in that everyone who enrolls is taught through personal correspondence by members of the regular University teaching staff.

Over 200 courses prepared specially for study at home offer to anyone anywhere who is espable of undertaking this work as opportunity to earry on his training under competent, interested University educators.

Whether your objective is economic advancement, keeper appreciation of the arts and sciences, or greater social service, write without any feeling of obligation.

The success of thousands of home study students has proved the real value of this

type of instruction.

A partial list of courses is given herewith. A bulletin showing the complete list including high school courses will be sent on request. If you will write us, we shall be glad to help you with your program of study.

COLUMBIA UNIVERSITY HOME STUDY COURSES

Accountled Agriculture American Government Applied Genman Banking Business Administratino Business English Business Law Business Organication Business Psychology Chemistry Child Psychology Classics Contemporary Novel Corporation Finence Drufting Economics English Composition English Literature Erray Writing Pire Insurana Foremenship Prench Geometry German Grammac Greek High School Courses Interior Descration

Investments Indian Juvenile Story Weiting Latin Library Sarvice Literature Macking Design Magneine Article
Wirting
Marketing
Mathematics Music Harmony Personnel Adminis-Philosophy Physics Playweiting Perchology Public Health Public Speaking Rent Boroto Religion Secretarial Studies Salling Short Stury Writing Snesalogy Spanish Strnography Typewriting World Literature, Etn.

PHAL OUT AND MAIL THIS COUPON TODAY	7.
COLUMBIA UNIVERSITY, Home 3 15 Amsterdam Avenue, New York Cit	
Please send me full information about the Courses.	Pop. Sel. 2-3
Nama	
Street & Number	
City State	
Occupation	hish you ar

A What About ANUITIES?

By LEON MEADOW, Financial Editor

BELOW is a letter received recently by this department. It brings up a question which we believe is general enough to be of interest to all readers of these columns.

Financial Editor, Popular Science Monthly, 381 Fourth Ave., N. Y. C.

Dear Sir:

I follow your financial articles each month with interest, especially those devoted to life insurance problems. Have wanted for a long time to see something about life insurance anouities in these columns. I think it is a form of insurance about which people are particularly uninformed, I know I am,

Have you neglected writing about annuities on purpose? I mean do you consider them unwise or unsound for some reason? I would appreciate learning more about annuities, in what different forms they are sold and what their purpose is.

> Sincerely yours, Arthur Williams, Rivers, Ill.

If Mr. Williams is under the impression that I don't favor annuities, he is wrong. I think the subject is of sufficient general interest to warrant writing my reply in the form of an article.

To BEGIN, let me correct an impression Mr. Williams may have given when he wrote "life insurance annuities." This phrase is somewhat misleading. Annuities, strictly speaking, do not fall under the head of life insurance, for the simple reason that they do not carry the face-toline death benefit by which all life insurance contracts are identified.

First examination of this statement may lead the reader to believe that annualies, therefore, have nothing to do with life insurance, but should come within some other type of investment classification. The truth of it is that annualies are a combination of both, being guaranteed investment incomes based on a conservative rate of interest plus an extra factor based on special mortality tables, as derived from the past history of many thousands of policy holders of this type. This will perhaps be clearer as we describe the various forms of annualties and the examples best fitted to each form.

SINGLE PAYMENT ANNUTTIES: This type of annuity guarantees the holder an income for life without return of balance of principal. Let me clarify that, The annuity must be bought outright and paid for in a single lump sum. Immediately thereafter, the holder receives an annual guaranteed income for the remainder of his life.

Suppose, for the sake of illustration, that a man at the age of sixty has at his disposal \$30,000 worth of securities. He has no dependents to care for, and is anxious to retire. His investments, if they average the good yield of 5%, bring him \$1,500 a year. But that's not enough, He needs \$50 a week to maintain a scale of living that approaches the one he new enjoys. If he turns that \$30,000 over to an insurance company and purchases an annuity for that sum, here's what happens. The insurance company will pay him \$2,793.30 a year for the balance of his life. This is \$54 a week.

HERE is what is meant by "without return of balance of principal": when he dies, the balance of his \$30,000 principal, (or difference between principal and amount he has already received in annual income, assuming that there is a difference in his favor), remains with the insurance company, and does not go to any heirs he may have. On the other hand, of course, the man may live to be 80 years old. In which case he has already drawn in twenty years of annual income the sum of \$56,286.00, which is almost twice as much as his original principal.

This type of annuity is also sold with a return of balance of principal, should the purchaser die prematurely. But naturally the income per year is less than in the above contract. Taking the same example, the man of sixty would receive \$2,373.30 a year or about \$46 a week. But, if he died at seventy, after receiving \$23,733 in ten years of annual income, there would still be some \$6,300 left for any dependent or beneficiary he might care to name.

From which it may be seen that the value of the first type is for the man with absolutely no dependents, but who has a strong need for maximum income while he lives. The second type is more desirable for the man who, while needing a larger income than could otherwise be obtained, also desires to leave something behind him.

The first type is likewise admirable for women affected by present financial conditions. A great many widows, left with sizable estates, now find themselves with greatly depleted incomes due to dividend and bond defaults, (Continued on page 7)

WHAT ABOUT ANNUITIES?

(Continued from page 5)

It becomes necessary to cut into the principal of the estate to maintain their scale of living. As this is done, the income decreases, and each year more principal is needed. It doesn't take long to exhaust both. An annuity, of the first type described, fits that situation perfectly,

GUARANTEED ENDOWMENT AN-NUITY; This form differs from the Single Premium Annuity in that payments are made annually over a certain period of years, rather than in one lump sum. Guaranteed Endowment Annuity enables a man to start paying a stated amount each year until be decides to retire, Upon retirement he will be granted a guaranteed annual income for life, on the same basis as already described-that is, either with or without return of balance of principal.

FOR a concrete example, take a man of 35 who decides he would like to retire at 65. Actually, he is not bound by the company to stipulate and to hold to his retirement date. He may terminate his payments when desired, and the guaranteed income will be paid accordingly. In our case, however, he is going to continue his annual payments for the full thirty years. He sets the smount he can pay at \$600 a year or about \$11.30 a week. After thirty years, at sixty-five, he decides to retire and to begin drawing his annual income. He is then entitled to \$34.00 a month for every \$100 unit which he has paid annually. In other words, he receives \$7.448 g year for the rest of his life. This is \$47.00 a week-more than four times the weekly payments he has made! Should the man die before his retirement age, and during the period in which he is still making annual payments, the contract has a death benefit, in so much as its cash value is payable to being or beneficiaries. However, similar to all other annuity contracts, it has no face-value death benefit.

This contract is designed primarily for those who do not need additional life insurance protection, but who do wish to provide a guaranteed annual life income for themselves, beginning at a period when their earnings have decreased or ceased entirely, due to retirement, No physical examination is necessary.

One phase of Guaranteed Endowment Annuity has a partial relationship to life insurance, It is possible in the case we have taken for the man to discover that, for one reason or another, he needs more life insurance. He can accomplish this by switching the annuity to any form of life insurance be wishes. The insurance then becomes dated back to the time when the annuity was issued and the premium is based on that date. Due to the fact that the man has been carrying an annuity contract, the cash value is greater than it would be in a life insurance policy in force the same number of years. This ad-Justment is also made. The most common instance in which this transfer is made is among the "temporarily uninsurables." That is, people, who through some temporary physical condition, cannot qualify for life insurance. (Continued on page 8)

Follow the Direct Road to Success

Do you want a better position and a larger pay envelope? There is just one way in win sources—be head and shoulders above your fellows by gaining a broader basic education. Mathematics is the lights of all education. Not a day passes in which you do not have to use gathematics to your work. To you make your own calculations, or are you handampped by your inability to do this work yourself? Here is the whole secret of numbers. This is why mathematics at quote in every school and college. A thorough knowledge of it makes clear so many things which are puzzling you today.

Do not let another day pass without doing something to improve your knowledge of mathematics. But how can you shall be knowledge. By going last to school or college, or take an expensive correspondence course! You need the partition!

At Last! Mathematics Self-Taught This Simple, Easy Way!

Now you can take advantage of this easy method which has been weaked out by an expect for those who do not wish to give the time and manny required by soher methods of mathematical study. A very simple and extremely interesting group of books has been prepared for you by a case who has devoted her life to teaching practical men the insedumencus of this important subject.

MATHEMATICS FOR SELF STUDY

By J. E. Thomoson, B.S. in E.E., A.M. Dept. of Mathematics, Pratt Institute, Bronklyn

These books mart right from the beginning with a review of arithmetic that gives you all special short-cuts and trick problems that save countless hours of your time and make you more valuable to yourself and your job. Then they go right into higher mathematics and show you how simple it is when an expert explains it for you. Don't let appearances fool you, mathematics is easy. You can get these books on approval and see for yourself how much enjoyment you can have white getting this valuable training and solving interesting practical prob-lems that puzzle your friends and fellow-workers. In no time at all you will be tackling with case the most difficult question on this subject.

A Complete Reference Work Four Inexpensive Books

ESTATE OF LE

destinant.

Starting from the first ample principles, these insertains books take you, by rapy starts, into the detailed applications of limited marketmates. Each size is clearly expanded and is followed diposity by samples of the starts. pile problems

Arithmetic for the Practical Man Algebra for the Practical Man Trigonometry for the Practical Man Calculus for the Practical Man

4 Valumes-1240 Pages-Illustrated

on Mathematics in These An Expert Gives You These Simplified Methods

Mr. Thengen the author of these leading is not an ordinary teacher of mathematics. He has had many years experience in giving students the kind of mathematical training they need in practical work. He presents each peartical method and problem in the clearest and simplest way. He gets to the clearest and simplest way. He gets to the clearest and simplest way. Look up any mathematical predicts that placed you in these books and see host quickly you get the solution.

Send No Money

Examine These Books for 10 Days FREE!

The compon below brings you the four books for 10 days' free trial. After 10 days, return the lanks to as without obtaining or send us the small down payment of \$1.65—balance in three monthly payments of \$1.00 cach 15% discount for cash).

MAIL THIS COUPON

D. Van Nostrand and Co., Inc., 250 Fourth Ave., New York. Send one MATHEMATICS FOR SEL will either return the broks or send years to be a send years of the send	F STUDY to 4 volum is 51.65 as first payment for cash.)	es. Within 10 days II t and \$1.00 per month (For. Sc. 2-33)
Same		
Address		
Chy and State	-	110101010101000
Business Connection		
Data-		

THE CHANCE OF A LIFETIME!

WORLD

GRUVE

FOR AS \$1325

including shore trips, visiting 140 world-renowned cities and places

SHARE in the world's wonders, Burmo-Bali-Barneo-Bangtak: All regular "Round-the-World features and many unusual places that give added distinction.

Steamship rates are going up, but they will not affect this cruise, Perhaps never again, however, can you enjoy such a comprehensive first class cruise at this low cost.



See your Travel Agent, any Dallar Line Office, or send for Booklet G-S

JAMES BORING COMP

COMPANY, INC.

642 FIFTH AVE., HEW YORK - - . 333 N. MICHIGAN AVE.

Goodbye SANDPAPER CHIN



Here Comes the New

DUPLEX SAFETY RAZOR

Everysory wonts on ALL DAY
shave—and here it is! Try this
NEW rozor—and get rid of that
"sandpapery" feeling that comes
a few hours ofter shaving. It's all
in the long blade—the shaving
angle — and the design!
Simple and sare. Nothing to

Simple and sure. Nothing to learn — just shovel Note these Important features:

Is ETTRA LONG double-edge blode 2: PERFECT BALANCE 1: CORRECT SHAVING ANGLE

4: NO VIBRATION. 5: NEW "HANDY GRIP" HANDLE 6: EASY TO CLEAN

DURHAM-DUPLEX RAZOR CO.

Jersey Edy, New Jersey Consider Office: Terente, Canada

FASTENING SHELVES to MASONRY WALLS

onry with a cold chisel, insert bolts with heads in to form study, and lamp remaining open spaces full of Smooth-On No. 1. Let the Smooth-On barden, then she the brackets, cleats or uprights over the study and fasten with outs or note and washers. A Ji-in, bolt set this way holds a man's weight without loosening. Use this method to anchor cellar shelves, partitions, wall calinate, etc., Makes a strong permanently tight connection that meets every press.

Use Smooth-On No. 1 also to stop leaks. Seals joints and cracks in pipes, boilers, radiators, etc. Tightens loose han-

tors, etc. Tightens loose handles, locks, hinges, casters, books, stems, etc. Makes stripped nuts, bolts and screws hold. Stops leaks in auto radiators, hose connections, cracked water jackets and gear cases, oil and gasoline lines, keeps nuts, lubricator connections, hub caps and wood screws from coming loose, makes dash supports tight and proof against nattle.

FREE BOOK Fattle.

Get Smooth-On No. 1 in 1-m.

I-lh. or 1-lh. tin from any hard-



House - Auto

REPAIRS

1

SMOOTH-ON

Do it with SMOOTH ON

WHAT ABOUT ANNUITIES?

(Continued from page 7)

Yet, in three, or five, or ten years they may be perfect "risks." Not wishing to lose the smaller premium accorded to younger age, they take out this type of annuity pending the time when they are again insurable.

SINGLE PREMIUM DEFERRED ANNUITY: There are some men who foresee, through force of circumstances, a need for a definite annual income for life to begin at some future date. It may be because they have some temporary form of income to provide for their immediate needs. Whatever the reason, the means are available through this type of annuity contract. It is bought outright, and the income, guaranteed for life is deferred until the specified date. Because of its terms, this contract brings in an even larger annual income than The Single Premium Annuity, described first in this article,

JOINT SURVIVORSHIP ANNUITY: As the name implies, this contract is written for both man and wife. It is ideal for the couple who are without dependents and who wish to buy for themselves a guaranteed income for as long as they live. In the event of either's death, the full sum of the annuity continues to go

TEMPORARY ANNUITY: This is a form of annuity contract designed to be carried in connection with life insurance. Ordinarily it is purchased by a man who already has some form of endowment insurance. That is, a man may have endowment insurance which matures when he is 65. At the age of 45 he may find that circumstances make it necessary for him to have an immediate income. Unwilling to cash in his endowment policy which is designed to take care of his later years, he

cash in his endowment policy which is designed to take care of his later years, he can purchase a single payment temporary annuity which will tide him over the period of years in which he will need the additional income, or until his endowment incomes making.

insurance matures.

That covers most of the more common forms of annuity contracts. It is not possible, because of apace limits, to describe some of these forms more thoroughly. Wherever practical, this department has attempted to analyse insurance coverage from a cost standpoint and to show readers of Populan Science Monthly what they pay for when they buy insurance, With annuities, it is impossible to do so without becoming so technically involved that no one including the writer, will be able to see what "makes the wheels go round." This is because annuities, as stated before are based on special mortality tables which in themselves are highly complicated affairs.

THERE is one more definition to be made, and that is an explanation of the ANNUITY OPTION. This is exercised in lieu of a cash settlement of a life insurance estate. The beneficiary may purchase a guaranteed life income instead of receiving the cash estate. The amount of annual income is determined by the age of the beneficiary (Continued on page 9)

City (Instrument

CONSTRUCTION KIT FOR MAKING A BATTLESHIP MODEL AT LOW COST

To ENCOURAGE you to build our new ship model, the battleship Texas, which is shown on pages 88 and 89 of this Issue, the Popular Science Homecraft Guild is offering a complete construction kit of materials for \$0.95 shipped postpaid to any address east of the Mississippi River. To points west of the Mississippi River. To points west of the Mississippi it is necessary to charge 50 cents extra because of the high ship-

PING COSIS

The amount of material required to make a model as large and elaborate as this—the hull in 3 ft. long—is surprising. Experienced model makers, most of whom have spent untold hours shopping for hard-to-get supplies, know this, but beginners often have the idea that they can go out and get whatever is necessary in the course of a Saturday afternoon. They quickly discover that the materials used in ship model making are not so easy to obtain, especially in small quantities.

Each kit for making the battleship contains five pieces of soft, straight grained pine for the bull, 15 by 644 by 36 m., all the necessary wood for making the superstructure, turrets, boots, and other parts, each piece being cut to the approximate thickness, width, and length wooden rods L/16, 1/6, 3/16, 31, and 5-16 in, in diameter for mosts, guns, searchrights, and the like; sheet brass in three thicknesses; three sizes of brass wire; two sizes of brass rod, 74-in, brass tubing for the funnel; brass tubing for the propelice tubes; soft metal and very small chain for the anchors, alk thread, large and small glass beads; pails, pins, and escatcheon pins-in fact every hing required for making an exhibition model except the paints. If a working model is desired the machinery, of course, must be obtained separately. The kit also includes a complete set of blueprints showing the model full size. Bought separately, they alone tost \$1.

If you wish to save yourself the work of marking and sawing out the five main bul, pieces or "lifts," these will be cut accurately to shape upon request at an

auch ional charge of 50 cents.

A coupon below is given for your convenience, but if you do not wish to cut the magazine, you may order by writing a separate letter

Popular Science Homecraft Guild.

Please send me all the materials (except paints) required for building a 3-ft exhibition model of the U S S Texas and also Blueprints Nos. 197 to 200

- I unclose \$6.95 (or \$7.45 if shipment is to be made west of the Mississippi River).
- Send C O. D

Name

Print name very cleary)

Address

City

State

Note The offer is made only to readers in the United States,

WHAT ABOUT ANNUITIES?

(Continued from page 8)

at the time of the insured's death. In all cases, it is much larger than the income derived from the usual investments made with the same amount of each.

To summarize, annuates are primarily designed to produce for the purchaser a guaranteed annual life income or an income over a designated period of years. The word "guaranteed" cannot be emphastaed too strongly, especially in these times of sadly deflated security prices. Even in normal times, security prices are subject to fluctuations which make it upwise to place one's entire dependence on interest yielding investments, Annuaties, bought from reputable companies are safe -with a rapital "S," and as such they deserve an important place in anyone's consideration of financial security and independence

To Help You Get Ahead

THE booklets fisted below will help every family in laying out a financial plan. They will be sent on request

The Investment Aspect of Life Insurance, by M. A. Linton, presents life insurance at an exceedingly worthwhile investment as well as a form of protection. Provident Mutual Life Insurance Company of Philade ship Pennsylvania, will mail a complimentary copy upon request

Before 65 and After explains the full details of a Retirement Income, with full Life Insurance, Disability and Double Accident benefits. Sent on request by The Equitable Life Assurance Society, 393 Seventh Avenue, New York City

How to Get the Things You Want tells how you can use insurance as an active part of your program for getting ahead financially Phoenix Mutual Life Insurance Company, 328 Etm Street, Harrford, Conn., will send you this booklet on request.

See How Easy It Is tells how it is possible to start off with a definite plan for creating an immediate estate leading to future financial security Get your copy of this booklet by writing to Postal Life Insurance Company, 511 Fifth Avenue, New York City.

"You Can Have An Income As Long As You Live," a booklet describing simply and clearly how the Annuity can be used to provide a gustanteed income for life. A copy will be sent on request to Inquiry Bureau, John Hancock Mutual Life Insurance Company, 197 Clarendon Street, Boston, Massachusetts.



UNRULY

Stays Neatly Combed

IS YOUR HAIR difficult to keep in place? Does it lack natural gloss and lestre? It is very easy to give it that rich, glossy and orderly appearance so essential to well-groomed boys.

Just rub a little Glossone through your hair once or twice a wrek—or after shampooning, and your hair will then stay, each day, just as you con a it

Glostora softens the bar and makes a pliable. Then, even stabborn hair will stay in place of its own accord.

It gives your hair that natural, rich well-groomed effect, instead of leaving at still and artificial looking at wayy pasts and creams do.

Chostora also keeps the sculp soft, and the bair healthy by restoring the natural one from which the hair derives its hunth, ife, gloss and les re

Try it! See how easy it is to keep your bair combed any style you like, whether parted on the side, in the center, or brushed straight back



If you want your hair to lie down particolarly smooth and tight, after applying Glostora, simply moisten your hair with water before brushing it.

A large bottle of Glostora costs but a undeatany drug store

Glostora

Our Readers Nothing Taken for Granted In This Business World While walking through a haspess street

of this city the other day, I saw a sign on the second story of a building. "Ding-Dong Print-

ing Company," it read, and, beneath, to prevent, I suppose, anybody's supposing that the concern operated a drug store, was the word "Printing." That interested me and I began

looking at other sign-Right next once was the Ajax Effectional Supply Company, which, to av it to se takes, anded "Electrien! Supplies" to that intend. The Modern hattature Consigny a sold fraren that a shopper or an aq tomol is might turce hu way into its show



coom, had the painter put "Furniture" under its name, The Big City Drug Company— Drugs, read another sign. Proceeding along, 1 found Stylish Hat Company-Hats, Bosco Arch Support Company-Arch Supports Neargold Watch Company—Watches: Tip Top Motorcycle Company—Motorcycles, I needn't catalog them all, you undoubtedly get the idea. I've changed the names a little, but have not aftered the fact Isn't there a need for a Society for the Elimination of Listlem Use of Paint, or something? Probably the value of the paint, time, and labor remired to place totally unnecessary information of this kind on the signs outside of business places, If saved, would be sufficient to may for the construction of Boover Dam. I mac ne it's just one of three things there's ne hing you can do about, but it struck for as so highly Hillculous I had to tell you about W C L Composition

There's Much Astronomy in the Course of a Year

I may been a subscriber to your moracine for some time and have enjoyed the special departments very much. As an amaleur in ustronomy and meteorology I would like to have you create a department "Helpful Hints to the Amaleur Astronomer and Meteorologist," Probably a large number of your reacem would join in this request. Hope my suigestion is received favorably by you.-R. F. E., Des Molnes, la.

How Shape His Iron Pail: Oval, Circular, or Square?

Walk one of your kind readers please help. me out of a frightful dilemma? I have a sheet of galvanized from forty inches by ten inches,

from which I am going to make a pail. Naura y I want il to hold as much as possible Now the question is in order to meet that requirement, shall I make the top of my lucket oval, observe remar or square? Or doesn't it make any ofference what the



stand, of course, that I have another proce of group for the bottom .- P C., Troy, N. Y

Homeccafters Organize a Club in Illinois

It is with great pleasure that we may now announce to you the organization of "The Hameerafters" club at Rockford, Ill. At our first meeting, where considerable enthusiasm was displayed, we perfected a permanent orgamestion with thirty charter members. The crafts represented are quite varied, covering practically every field of endeavor applicable to "Homecrafters." We expect to have stated meetings every two weeks and have made arrangements for a series of lectures, both oral and illustrated, covering the various crafts. While the club is still a tyro, we cannot recommend too highly the organization of similar clubs elsewhere.—E, R, D., Rock-

Can't "Our Readers Say" Keep The Wolf Away?

I HAVE been a reader of Post's in Science, MONTHLY for a long time, I was a subscriber before this department was added and the fact that I have refrained from writing to you is evidence of great self-control and of the sore peoplexity that prompts me to write this. A question that has troubled me (or some time is. Was Our Readers Say the cause or result of the world depression? If I remember correctly they came upon us about the same time. I had not let the matter frouble

me mack until I received the current issue and samultaneously read the news that wheat had reached a new all-time low. I have hever seen a rational appear to any other question to it would hardly be fair to yno-or myselfto extend you to give a rainba answer to



his one 15 you for theel that you or any of your reader on answer if just rose if up I guess it want make much of fictinge And one who is neht hearten or heart to rico ah so see anothing onny in your exturing will not be legts after on his the occur with and if he is keep enough to see a point in any of the answers (or questions, including this one). he can lift himself out of the depression. So please keep right on with Our Readers Say and also with the less important matters of science and invention to which you have always given a large amount of valuable space, S. P. Fallon, Nev.

When Engines Run on Water Old England Will Have Them

As a computatively new reader of Popular, эсимск Мохтилу, may I сарген my арргеctation for the pleasure and interest I have derived from it? The main object of my letter, however, is to answer the suggestion made by Y. E. J., Pasadena, Calif., in a recent isne recarding an regine run on water. Some time ago an office of the Royal Air Force took out master patents for an internal con-

bic-from chaine run un water. In his engine water flowed into a lead plate battery where it was transformed into hydrogen. The gas, then fed into the cylinder in the usual way was compressed and ignited Practical tests were claimed to be very natisfactory - J B M., Newcastle-on-Tyne, England

Then The Musicuppi River Must go Rollin' Uphill

Do wit always travel downward? A few years ago a world-renowned astronomer wrote. "In the realm and reaches of stude,

there is neither up nor down." With that in mind, perhaps several fradebillo. Por Mi SELVE MENTHLY may wish to send you. their views on the foltowing thought Asthere are no spots on the miobe that are always called top and bottom, cannot any orlividual say that the



spot where he stands is the top of the world for him? If so, then does not any individual, traveling, always go downward if surface irregularities are discreprised? He would go desce from London to New York and descenfrom New York to London. The confusion arises, I think from our human way of repariting objects and locations practically always as relative to something else. In traveling over our clobe. I think there is neither but not down but, and perhaps properly, outward and around. Yet it would sound out to speak of going outward to London or around to Paris. I should the the views of others on this question of reality in direction or father direction only as there may be no such think as reality in direction.-A. V. L., Ph.indelphia,

You Short Wave Workers. Take a Look at This!

THE request of W. S., McAlester, Okla , for an article on the construction of an intraviolet transformer his nos hear's ene ricement 1 d like to soak up some a 11 votet to self this winter and I believe I clean manage the pure at the a presther with the sty or sevence five cen a to rth of mit ral that is gal goes in a the ransformer and the in sent date of my finances does not sermit the price of a factors due, outfit I was que e

enthused over the short-wate articles recently published, and even thought of tions to case y for an amaleur la ense un I acquired a combinat un receiver After listening in a couple of times, I conc-uded there was no resident to the ase in anyother amateur How-



ever, I come con an excessor idea one evening while fellening to an amateur of the remake hash of a good short-wave program. I'll let you in on it before I pass it on to the over-worked Federal Radio Commission. Why not gather all the licensed amateurs into one large city and then surround that city with a thick insulating wall of Heaviside Layer? Then let them pound the key or talk to their hearts' content. If this should find its way into "Our Readers Say," please tell the entaged amateurs to call their shots.— W. G. W., Martins Ferry, Ohio.

Here's a Suggestion for A New Confusion of Tongues

As I have not yet read or heard of auto racios being used in the commercial world, I have decided to write to you, and set forth some of the ways they could be used to ad-

vantage. First and most important wound be in the taxi business In our larger elements where two or three companies own handreds of cabs and have them scattered over the entire city either answering or returning from trips at all times, all culticuld be sent to one



rentral office and then broadcast from there. thus el minating branch offices. The radios · I be made so that after a driver received his call and picked up his fare, he course tone his radio from his low wave length to a higher one, and receive a program to his passengers' liking. After completing his run, he would call in and tell the office his location then tune his radio back to his low wave length and wait for a call that would be near him. In the express business in larger cities, companies having a large fleet of trucks have contracts to hundle their freight and deliverses. The pystem new used is to have the circ era ca in at short intervals in secifiany new calls have come in near them I is system amdar to the one above were used, a great deal of time would be saved, and fewer trucks would be needed as none would be tille at any time.-- B BlcM., Denver, Colo

Image of the Work Done Appears on Spectacles

With some worldly-wise man tell me the wheren and wherefores of the following facts, to-wit. A woman came to my office to see if I could clear up her typ plasses. They were of the bi-local type, the lower lens having been remented on to the main glass. On the left glass were plainly seen white figures or designs she had embroidered on a pillow sham, work ug by electric light, and on the other a mulberry leaf design. How did they get there?—J. M. H., Wise, Va.

How Old Is Ann? Take

Hank's one that will keep the parl friend from putting anything over on you in the matter of upe, and I feel that Our Readers Say should have the

Say should have the benefit of this bit of wasdom. The age of a woman can be teld by her eyebrows, according to a statement recently made by a British scientist, Eyebrows, he said, change their postion as a person grows older. With age, they sink below the upper mar-



gin of the eye socket and makeup is ineffective in biding this evidence of advancing years. Brow lifting comes next, I suppose!—E. T Providence, R. 1

Providence, R. I.

Bank Robbers Will Please Pose for Their Photos

I stare been reading in the Portean Science Monthly about how a Doctor Kilmer is able to tell a triminal by his ears. A few weeks ago in a town near Grand Rapids a bank was field up and two or three people mounded. The bandits made a getaway without anyone noticing just what they looked like I wonder why banks couldn't be equipped with still and movie cameras so in case of a holdup the teller rould trip a lever and put the cameras into action and get pictures of the holdup which would give the police something to work with.—G. S., Grand Rapids, Mich

Nature Well Coddle Our Earth So It Can't Explode

C E. S., Mason City, Inwa, wants to know, "Why doesn't the earth blow up?" This probably will never happen because the breaking up of the earth's surface would indicate too much outside pressure rather than too much from within. Let us assume that when the crust of the earth was in its gaseous state, being trushed into a solid by two contending forces—heat inside, cold outside—that these two forces were equal, their meeting place being midway between the outer and inner

surface of the earth scrust. When the surtace became right, the
outside force became
the greater and conlinued to increase until the surface collapsed equating out
mountains and valter The shrinkace
may he ver occur
again, and it is reasonable to uppose



that nature will protect the inner surface of the earth's crust from excessive heat just as it protects the outer surface from excessive cold—E. L. M., Altoung, Pa.

Here's a Hint to the Army of Hard-working Inventors

Ove budly needed invention is a new, better, pleasanter, and painters substitute for the dyptic pencil now used to stop the flow of blood from razor cuts. Something cheap and southing would be the lide A. V. New York, N. Y.

Followers of Einstein Might Like to Answer This One

The article in a recent roughly for the be about Morette y regar long the latest to salts of the M hels n wht measurements was extremely interesting. It showed that with the new mile long tube the measured speed of light differed by fifteen miles per second from the former determinations. This is not a great difference in a speed of approximately 186,000 miles per second; and similar differences have been found in all previous expenments. The real interest, however, lies not in this discrepancy with previous measures, but in the light it throws upon the basic expenments of the relativity theory. This theory was entirely based upon the assumption that the Michelson interferometer of 1887 was capable of measuring the relative speeds of two beams of light to within a few methes per second. Michelson made six determinations of this difference on three days, and his apparatus gave differences varying from a few inches to about three feet per second anslead of the theoretical difference of only five teet Einstein and his followers disregarded three printed statements and asserted that Michelson tound on difference I as a this di tortion of act the whole theory is based. But I a termore than first years is approment, it is impossible to determine the actual velocity of light to within fifteen miles per second, is it not absurd to base a revolutionary theory of physics and astronomy upon the failure in 1887 to measure accurately a difference in speeds of two rays of only five feet per second?—C L. P., Greenport, N. Y.

Naturally, if You Sleep, Your Insomnia Is Licked

How the old ones bob up every now and then with all the fresh freezy of youth? I have just read that a French physician is

telling his patients to sleep with their heads to the north and their feet to the about to avoid fasouria. The magnetic currents thus pass through the body to a breet movement from head to feet he explains. This was old seets years ago. Besides, I



don't see what difference it makes what posttion you're in. If you sleep you surely won't be troubled with insomnia, what?—A. H., Forest H. is, L. I., N. Y.

Earth's Magnetic Field May Make Light Hesitate

AN APPICLE by John L. Coontz, in a recent ssur in Point for better & Messa A. described the tube used by Dr. Michelson in testing the speed of light. A friend and I have indulged in considerable speculation regarding the possible cause of the arror recent by discovered in the speed of light, and figuily decided to write you for the purpose of obtaining certain information. In what direction was the test tube when the test was made from mountain peak to mountain prak. from east to west or from north to south? When the tube was set up to make the test did they set it up so that the test took place to the same direction as the previous test? Is it possible that the earth's magnetic field has a returding influence on the speed of light when the travel of the light may light right angles to the earth's magnetic field? There b the further possibility of error because of the fact that both of these tests have been made along, or near, the surface of the earth It is not possible that the speed of light is reduced a trifling amount when it is in the presence of an influence such as a body the size of the earth with its attendent atmosphere, magnetic field, etc? One point on which my friend and I differ is regarding the action of a magnetic field in a vacuum. Do magnetic lines of force deflect from their course to avoid a vacuum or do they contimue uninterrupted on their course?-L, S.,

Many e Man Is Thankful He Hasn't Four Legs

Tate dumbest four legged creature on earth is the frog, according to Harry F Harlow, psychology professor, at the University of

Wisconsin, who recorded the time required for a frog to react to various it in uli. These records showed it reacts more slowly than any other laboratory atomal and that it learns nothing from experience. Wasn't it nice of Professor Harlow to confine his statement to

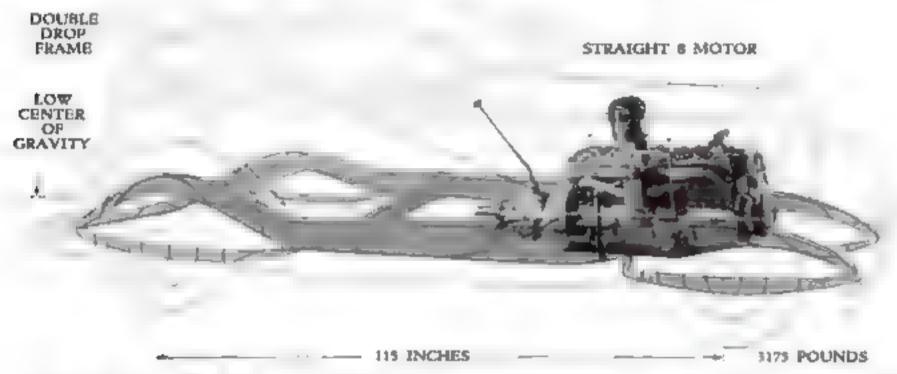


"four-legged creatures?" Where d we get off if he hado't? And what relation does that make us to from?—J M M, Pittsburgh, Pa.

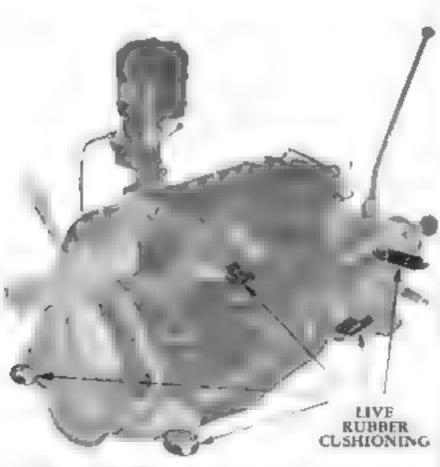
FACTS you'll want to know about General Motors' new PONTIAC Straight 8

Everybody interested in things mechanical will want to know about the many new and practical ideas General Motors engineers have developed in building the new Pontiac Straight 8. Here are some of the outstanding features—look for more in next month's issue. Pontiac is a big Straight 8. The power plant is a

new, smooth, 77-horsepower engine, L-head type. Full pressure lubrication. Perfect balance of engine gives greater smoothness. Capable of 75 to 80 miles an hour. And the new, big Pontiac is priced right down in the low-price field. Mechanics and shop men are particularly invited to inspect the new Pontiac.



There are \$174 pounds of weight in Pontiac's 114 such wheelbase two-door spiles. The double-drop frame, with 6 cross-members, is specially but I in give the charms after strength and rigid in Rubber cushioning at 37 charms points affords unusual rading case and quintaess.



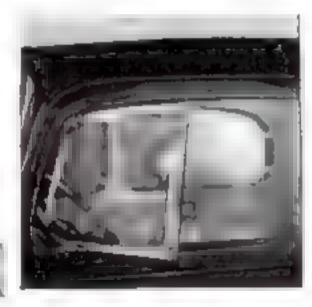
Pontiac's Sees ght Eight engine is mounted on 5 steel-reinforced rubber supports, channeling all metal to metal contact between engine and chars 5. This construction ends sibration and torque reaction throughout the curve driving range, 5ct keeps engine sensibly anchored to frame. Notice three types of mounting total,

Fisher No-Draft Individually transmitted beamining on closed models is the higgest improvement in rading picus are means. Side windows and he repartably regulated to a repart the remilation desired. Supply drafts—persents colds. Prevents the dangerous amorphory of statuted windows,



At an point in Postaic schassis there are cashiologically of the Compressed rubbet, such as it awarded above. This cushioning is sixth prevents squerky and rardes, of minutes within 10, soft mit road to its and jury, thus adding to exting comfort.

Postare ness the expection radiator. This ripe of reductor in manages the area of water or some freeze liquid by ho i ng or sapor ration. They we tank sare separated, and steam or sapor cannot reach the over flow pape without first certaining through the liquid. Makes it possible to keep the sugme thoroughly cooled with less water—only expoughly required to cover outles each. Capacity 15 quarts. All copper core, boney tamb type. Reduces that and cortonom.







POPULAR SCIENCE

MONTHLY

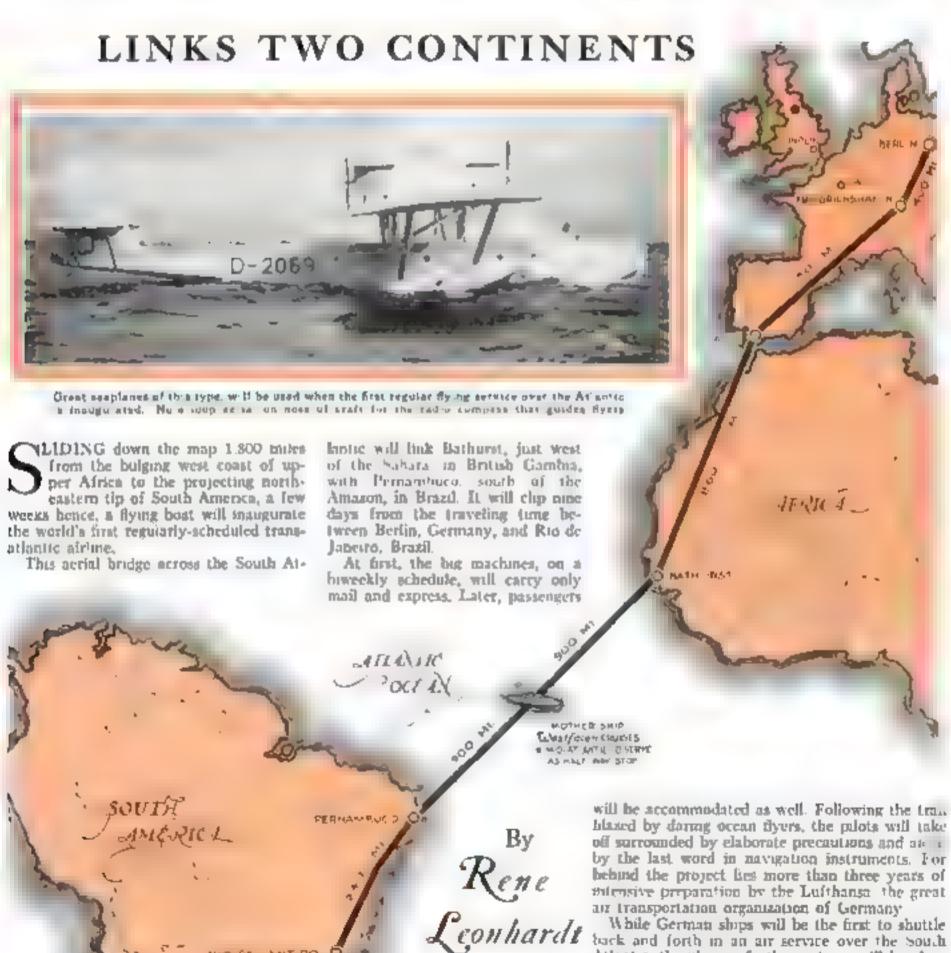
February 1933

Vol. 122, No. 2

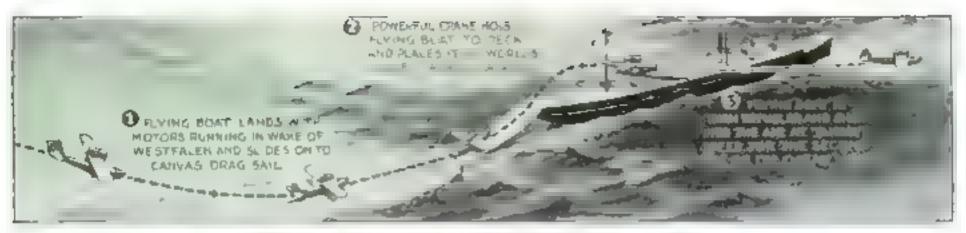
RAYMOND J. BROWN, Editor



Transatlantic Air Line



Atlantic, the planes of other nations will be close behind. Both France and Italy have entered the lists and at this writing are putting finishing



REFUELING A SEAPLAND AT MOTHER SHIP 900 MILES PROM LAND

Drawing shows how the transationare fivers with be able to land in mid-ocean, refuel and take off again on second leg of the journey

touches on plans for nimitar links across the sea to South America

Four large flying boats are pearing completion in French factories for use in a transationtic arrane which will connect Parts with Buenos Aires, 5,200 miles away in the Argentine. On this route, the hopoff for the ocean crossing will be made from the African coast at Dakar, on Cape Verde, a hundred muses north of Bathurs!

For the last two years, Italian experts have been busy compiling weather data and other information vital to a transoceanic airline. They have even worked out time-tables and emborate cost figures La est advices from Rome indicate that the construction of the Italian planes will be pushed forward at top speed.

While the race is thus on over the South

Atlantic, the powerful Pan-American Airways, in the United States, announces it is building six giant flying boats, larger than anything hitherto flown on commercial arrimes, for use over the North Atlantic between America and Europe. These fifty passenger planes, designed to fly 2,500 miles with full load, will probably go by way of Greenland and Iceland, They may also pronter on an airway to the Orient, crossing the Pacific with one stop at the Hawanian Islands. The keels of these superplanes have already been laid and work on them is progressing at the Sikorsky plant, Bridgeport, Conn., and at the Glenn L. Martin factory, Baltimore, Md.

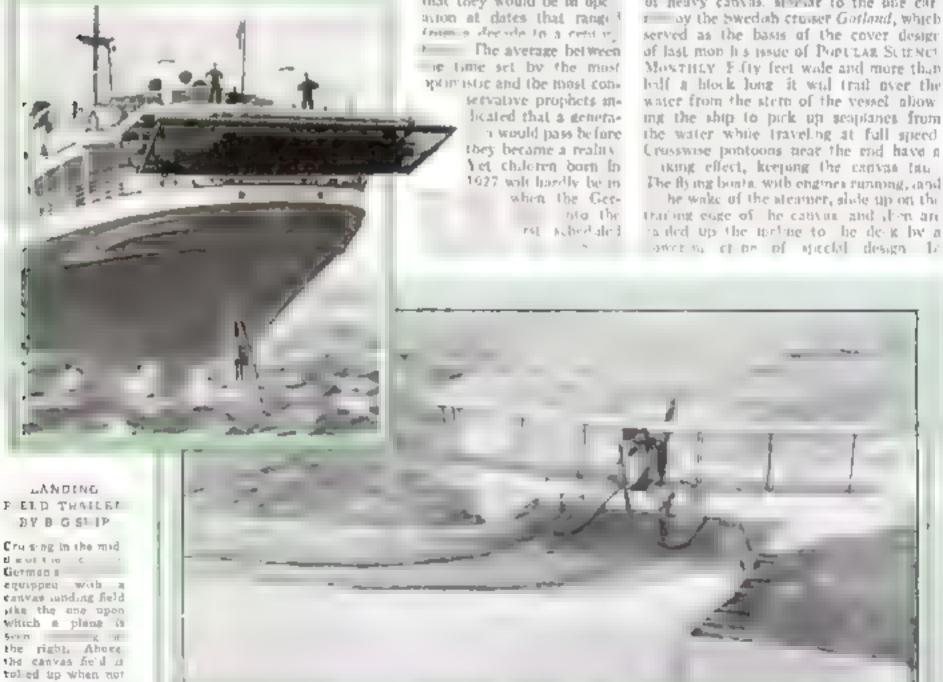
In 1927, when Charles A. Lindbergh made his historic thirty-three-hour dash to Paris, the possibility of transatlantic

> airlines was discussed on all sales. Predictions were made that they would be in our action at dates that range ! francis decide to a consist. The average between primistic and the most con

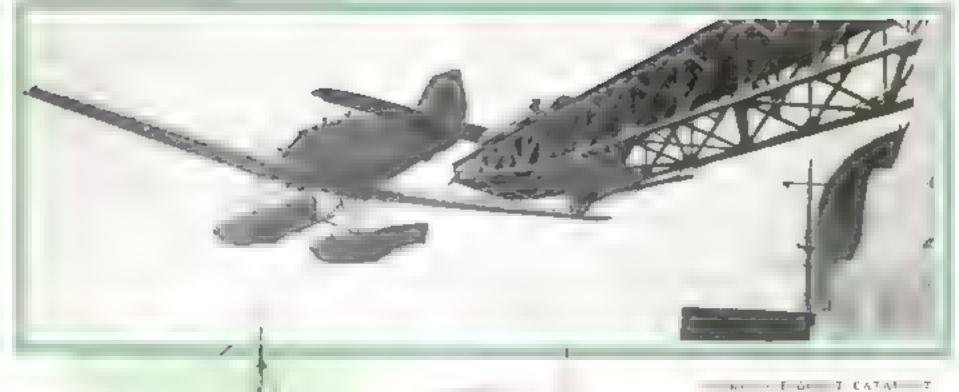
America in March or April of this year.

The most unusual feature of the German plan is the Westfalen, a 6.000-ton North German Lloyd liner, which will cruse about in circles 900 mues from shore and act as a refueling station and repair depot for the aerial fleet in midocean. The 409-foot vessel will carry tools spare parts, fuel and oil. Expert mechansea will stand ready to repair or tune up an incoming plane at a moment's notice. From a powerful breadcasting station on board, signals will flash to the airliners speeding toward the circling ship, giving its position and bourly weather reports. In atorms or heavy weather, the Westlaten will form a midocean barbar of refuge for the planes.

I nder such conditions, one part of the unique vessel's equipment will be of speor value. This is an impreense drag and of heavy canvas, service to the one carr oy the bwedah cruser Gorland, which served as the basis of the cover design of last mon his issue of Popular Science MONTHLY Fifty feet wade and more than half a block long it was trad over the water from the stem of the vessel allow ing the ship to pick up scaptanes from the water while traveling at full speed Crusswise pontoons near the end have a



needed by a plant



The radio room of the transmittent a planes is located if really behind the or or and the operator is in constant automorphisms with the far distant market ship.

stormy weather the dragging canvas will create a strip of relatively smooth water behind it, thus aiding the pilot in landing

his heavy ship.

A few days ago German liners, steaming out into the North Sea from Hamburg and Bremen, passed the Westfalen off the island of He goland. It was dragging its long white train behind it, carrying out painstaking experiments to determine the best speeds for different water conditions. I me and again, during this three-day test, a big Dormer-Wal flying boat swooped down, skimmed over the water and alid up on the canvas while the Westfalen was being draven ahead at full speed by her 2 700-horsepower engines.

Immediately afterwards, the big ship

docked at Bremen. Here, workmen began installing the world's buggest aerial catapult on her deck. Driven by giant blasts of compressed air from a battery of beavy steel cylinders, this 150-foot gun will have sufficient power to shoot a loaded fifteenton flying boat into the air at takeoff speed. After the machines of the ocean service have been pulled up the canvas drag sail and refueled, they will be shot off the deck from the catapult to begin the second leg of their over-water journey to Pernambuco.

The present catapult launching record is held by England. In the summer of 1931, at the Farnborough flying field of the Royal Air Force, near London, a land catapult, with a 4,000-horsepower com-

By means of a grant cataput a a come use above above the planes who has added into the air from he is the big liner Ar tale, the Western

ressed are engine, hur ed a nine-ton nemoing plane into the air with a run of minery feet. The II cattal in engapite may test design to these now used on the North German Lloyd liners, have he and his men, to taunch mail dance as the vestle draw near to the tuests of letter with America or of Europa

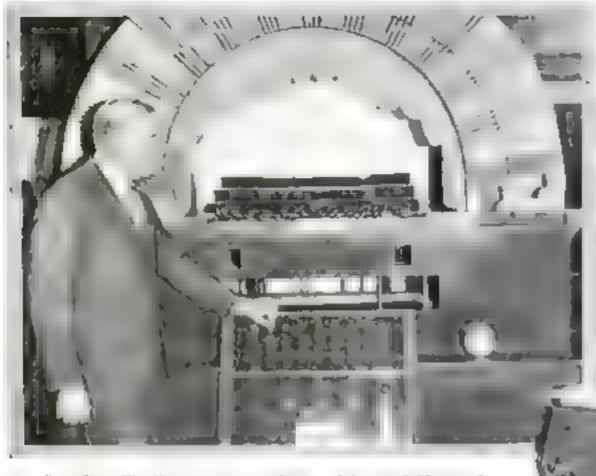
Recause of his whom experience was a cataput s. He are Bair kenburg,

In ship-to-shore priot, has been to the car role up to the series of the new on a rotate over which parace returned with race from Brown and a will carry them series and sangers, as so boosts At any

hat is arrier. The start from beron is a by le betwee moon. Tempel is Amort, the busy hub of Europe it skyvays, is at the height of its account. Air here are coming and going. The roar of ig met as the har At the surers signal the land plane which will cover se first legs of the long journey, specia lown the curway of a ba slowly in a the ir, and he is south over a patchwork thet of farms spread out half a mile below. Potsdam, Le pag. Nuretr berg pass by Ahrad is the blue water of Lake Constance with the white backbone of the Swiss Aps rising above it. A few primares later the plane spirals down to a landing at Friedrichshafen, 400 miles south of the point a which look off.

Fact is sumper into the tanks in this stored away on board and the shorts off again, out over the lake and the huge Zeppelm sheds on its shore. In wide circles it climbs to nearly 15 000 feet before it heads south clearing the snow covered harner of inclinations and suding down over southern France to the second heading at Marseilles 800 miles from Berlin Here, it refures and takes off he floodlight, climbing over the Pyrenees and heading diagonally across Spain. The landscape below spreads but in mooningb hims by the ship comes down to be play to be aftered by the ship comes down to be play to be aftered by the ship comes down to be play to be aftered by the ship comes down to be play to be aftered by the ship comes down to be play to be aftered by the ship comes down to be play to be aftered by the ship comes down to be play to be aftered by the ship comes down to be play to be aftered by the ship comes down to be play to be aftered.

World's Biggest Stage



Radio City Music Hall Equipped for the Most Elaborate Effects in the History of the Theater

Perer Clark. New York arch tost and designer of the remarkable stage for a showing the mode used in hunding the stage Radio City Music His

5 THIS issue goes to press the world's largest induor stage a wondersam it ingenious mechanisms at the R. die City Music Hail Rockefeller Center New York Cry is ready for its first performance, Elaborate mechanical features, shown here by our artist, will make possible the presentation of super-spectacles, ballets, band concerts choruses variety acts, circus performances, ministreis with scena effec a never believe attained

The riage, .48 feet wide and eighty feet deep, can be raised or lowered hydraulically in three sections, presenting different levels. In addition, a circular center section, fifty-five feet in character, can be revolved in either direction. When each posttion of he stage is assumed, the sections automatically lock in place. This is said to be the first time a revolving stage and a stage that can be raised and lowered have been combined. The cessign was worked out by the New York firm of theatrical architects Peter Clark Inc.

I'win pipe-organ consoles mounted on wheels roll into view one on either side of the stage, when in use, and slip back into special atcoves when the organs are silent. Another feature is a motorized archestra pil, seventy-five feet long and holding more than a hundred players, which rises into view at any one of three different positions on the stage

Experts, standing before long rows of electric buttons in a small pit in front of the stage, control the movements of the various sections, the appearance and disappearance of the organ consoles and the rise and descent of the orchestra pit. In orler ion, they adjust the position of a mammoth contour curon n at the tron of the store. Thereen attitudes each with a separate electric motor, permit it to be draped into any one of a score of different post ions, o at air annuns. I scenic effects

The unique amor-plate construction of the ceiling of the had permits special spotlights to be played upon the stage from openings between the various overlapping sections. Runways and compartments for the operators of these lights have been incorporated in the design of the roof of the building

On either side of the stage, steel light towers, thirty feet high, hold from seven to twenty-five spot and floodlights, fed by electric cables dropping from the ceiling. These towers are mounted on wheels so they can be moved about to provide spectacular lighting displays. Behind the stage a special room broadcasts sound effects while a projection booth adds to the rea ism of performances by scenic effects flashed upon a screen



STAGE MODEL LOOKS LIKE REAL THING

A working model of the Music Hall stage, at top, in which many of its mechanical features can be seen. Above, a view of the stage as seen in a photograph of the model. Note the contour carrain at left

Is Marvel of Mechanics

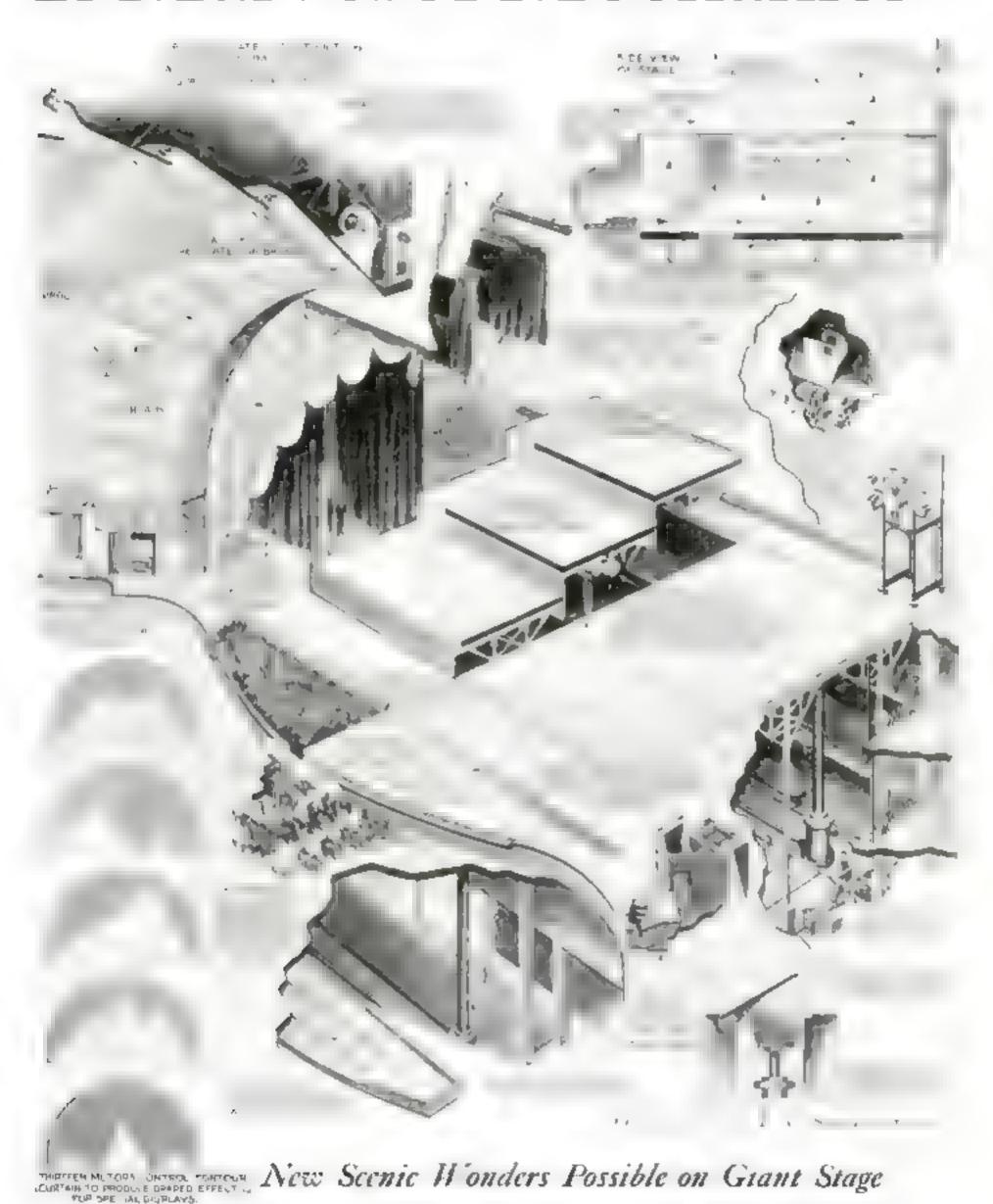
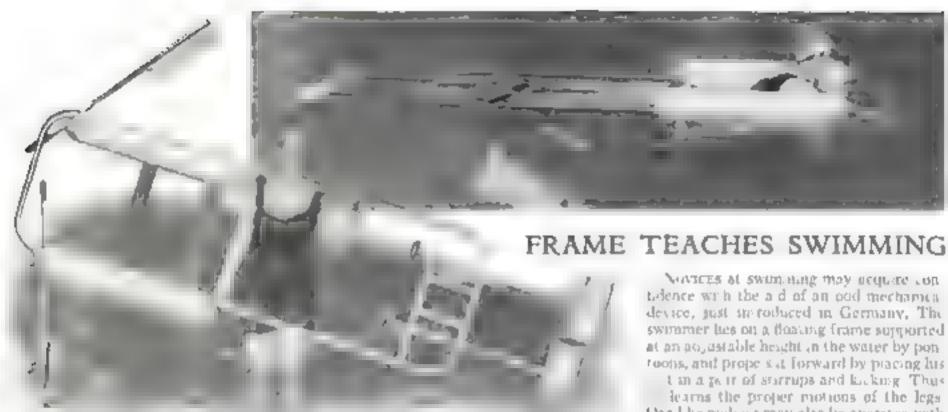


Diagram of the world's biggest stage, showing in detail the sectional nature of the stage which can be raised to three different levels and also revolved in either direction. Note orchestra pit which can be dropped from view



When this frame with its supporting puntones, in laid flat, a the water or will nearain a aw nunes a weight, an aren at top, and progress is made by highing paddles and working dark

NOVICES At Swimming may acquire contelence with the aid of an ood mechanical device, just me toduced in Germany, The swimmer has on a floating frame supported at an acquistable height in the water by pontoons, and prope s a forward by placing his

learns the proper motions of the legs Our like pudous may also be operated with the arms. The hinged propelling this open automatically when pushed backward against the water

NEW INDOOR GOLF TEE



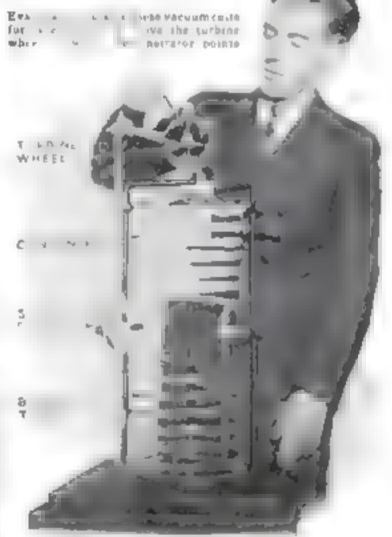
INDOOR golf practice without damage to the floor is possible with a new zubber mat. A rubber tee is attached and a soft ball is tethered on an elastic cord

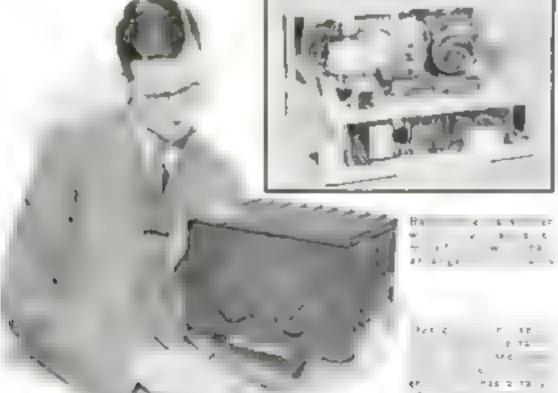
RADIOPHONE FOR PLANES WEIGHS ELEVEN POUNDS

AN UNLEUALLY compact radiophone transmitter weighing eleven pounds, has been developed for small planes by empneers of the Bell Telephone Laboratories. With this a pilot may call an airport and ask the condition of the field, direction and velocity of the wind, and what obstruct one interfere with lanuing. The transmitter has a range of thirty to forty imles

A TURBING wheel spins continuously, despite the absence of any visible source of power in a glass model called by its New York builder "the nearest thing to perpetual motion." Its closed circuit of glass tubing is exhausted to so high a vacuum that water, in the bottom, buils at room temperature. Rusing steam drives the tiny turbine and then condenses in upper tubes, which are kept twenty degrees cooler than the room by a most wick wrapped around them This cooling effect by evaporation is the real motive force. As long as the tip of the wick is kept in water, the device develops about 1 60,000th of a horsepower, enough to demonstrate a new source of energy

LOOKS LIKE PERPETUAL MOTION





CIGARETTE CASE FOR AUTO

A CIGARETTE COSE that clamps to the steering wheel of a car makes it unnecessary for a driver to fumble through his pockets for a smoke. It is instaded in a few seconds with the aid of an adjustable metal clamp. The case has a pocket.

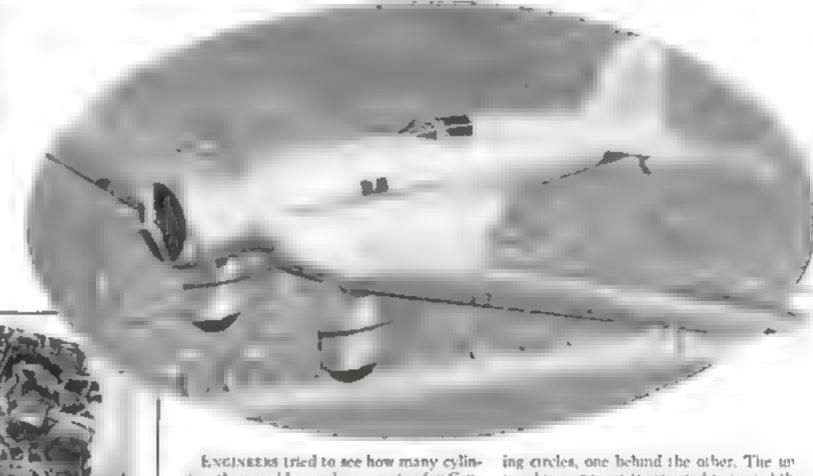


for ficense papers. This case clumps to steering wheel

Fourteen-Cylinder Motor in Hawks' New Plane

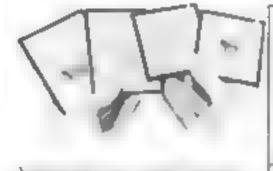
right shows the new a) mera apend plane just completed in a Car fore a shop for Capta o Frank Hawks. It has a top speed of 250 m les un hage and to fitted W h instruments for blind flying

Fou leen cylinders in Hawks plane are arranged to two circles to a sist in the photo below. The motor wal develop ages 300 basespower



ders they could crowd on a motor for Captain Frank Hawks newest speed plane. The result was a 700-horsepower engine with fourteen cyanders arranged in two adjoinusual power plant is expected to propel the bullet-like craft of metal at a top speed of 250 miles an hour and enable it to set new transcontinental records

CROSS-EYES NOW CURED BY PICTURES





ILLUSTRATED LECTURES GIVEN BY MACHINE

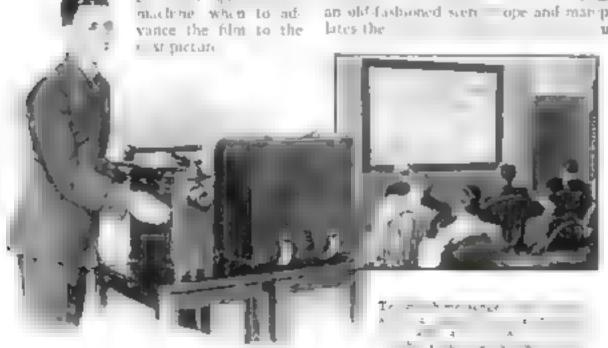
CANNED lectures may now be had in two dozen large cities, and soon will be available in many more, simply by calling a telegraph messenger. He brings with him a new type of talkie machine that delivers a talk on the desired subject from a wax record. Its projector meanwhile throws still pictures one by one upon a screen, A warning

bell notifies the messen-1 / 10

Curing cross-eyes is play for youthful petsents at a New York eye bure, opened recently. A child places a pair of attractive military)

an old fashioned seen to ope and man pulates the

together. Thus he tries to trap a lion in a cage or catch a butterfly in a net, Through corrective exercises of this sort, a cure is often effected without recourse to a surgical operation, which hitherto was nearly always considered necessary



REEL PART OF FISHPOLE

With its reel built into the handle, a new casting red offers advantages to fishermen. Since the reel is an integral part of the outfit, it cannot be lost nor come loose at a critical moment Reci and handle are made of aluminum alloyand the gap is formed of engle.



AMATEUR THEATRICAL SCENERY COMES IN COMPACT KIT

Antone may audid his own scenery for amateur theatricals, with the aid of a new kit designed for use with a stage depth of about twenty feet and a proscenium opening of thirty-five feet. It includes complete scenery hardware, sizing, and glue, with full plans for three different arrangements of scenery, and suggestions for painting the set. Openings for doors and windows are provided, as well as materials for a frepace, leaving only scenery been and frame lumber to be purchased



Everything occurately to the hatdiding of genery for ambieut thears calls, except the fines and frame lumber in onto sed in this list which is designed to provide accept for a single twenty by harry-five eet is a re-

DISK WINDMILL IS HURRICANE PROOF

Proof against burricanes is a midget windmul devised by a Miami, Florida, inventor. The queer-looking disks that serve as vanes automatically drop off if struck by a gale, leaving the frame undamaged. If broken, the disks may be replaced at a rost of only five cents apiece, according to the inventor. Several of his neighbors, bying in a region subject to violent storms from the sea, are using windmils of this novel type to pump water.

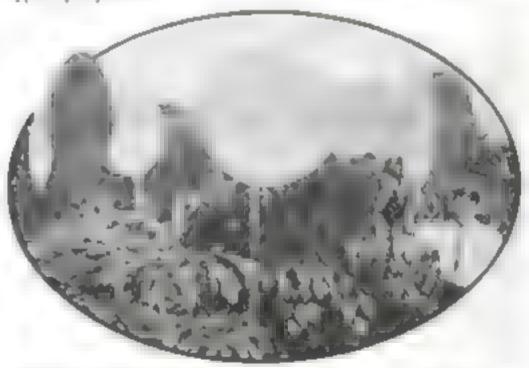
ALL METAL DISHES BARRED BY ANTARCTIC EXPLORER

Witen polar explorers at down to dine tableware made of wood in considered good taste. Metal cutlery, unprotected from the frost of sub-zero temperatures, would stack to their lips and "burn" the skin away. The photograph below shows wooden forks, spoons, bowls, belaying pins and dog harness torgies just completed for Rear-Admiral Richard E. Byrd's second Antarctic expedition by a New berg, Ore, woodworking concern. The maker is not permitted to use the least bit of metal in making these implements, of which a complete supply has just been delivered.



FLAGPOLE, IN TRUCK, CROSSES WORLD'S BUSIEST STREET

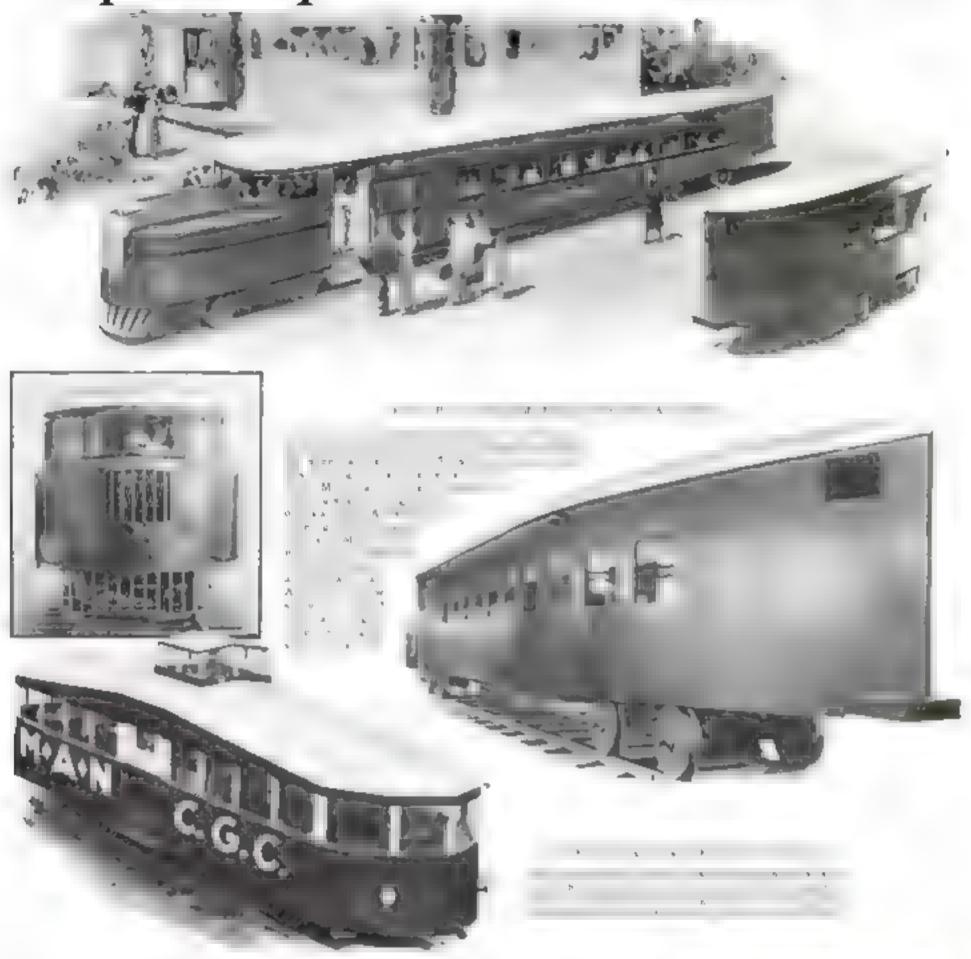
CARRYING a flagpole, nearly 100 feet long, from the Nev-York Public Library to the repair shap recently gave moving men a problem. The pole was loaded at what is probably thworld's busiest traffic crossing. Forty second Street and Fifth Avenue. The movers cut a hole through the body of a truck and pushed the pole abound as shown in the photo at right.



Disk vaces, driving this windowld, drop off with I the damage, if bit by a gale



Airplane Speed in New Rail Buses





TWO CARS FORM WORLD'S FIRST STREAMLINED TRAIN

Designed for use on the road between Berlin and Hamburg. Germany, this streaml ned train, consisting of two cars located together can which along at the surprising speed of ninety males an hour powered by a bugo Diesel motor. The train was developed after experiments with an air driven Zeppel is car



Making Mariners in College

Vingth

Vin Christ

Linersite

Is Longit

About Yields





Young German Builds Radio-Controlled Boat

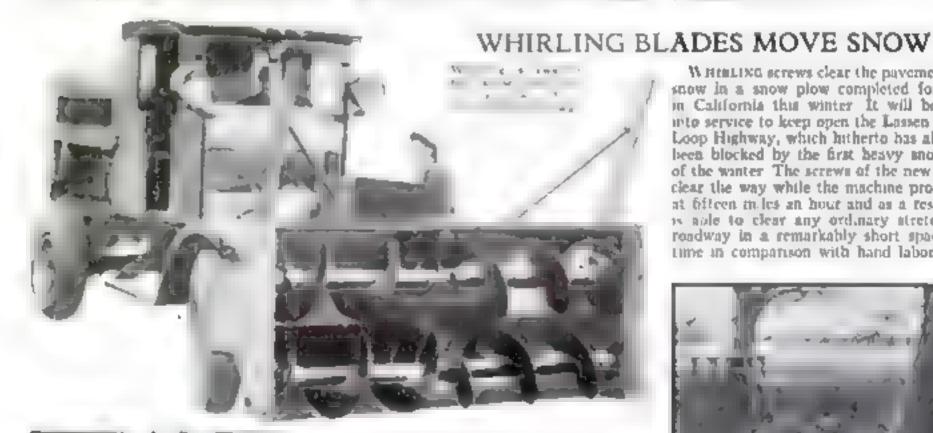




na gorn age Ateyta, ten oe

A GERMAN schoolboy, Rudolf Weber, has astonished the residents of the little North Sea village of Neumark, Germany, by building a model boat that he can control by radio. By turning a device like

a steering wheel, attached to a short-wave radio set, he makes the boat turn to left or right, and it will also start and stop at his radioed command, Storage batteries crive it. The feat is remarkable as young Weber built and assembled every part of the boat himself. He also constructed the radio set that controls the model and is now planning a larger apparatus for a passenger-carrying bear



FERRY ON CABLES CAN CARRY ONE PASSENGER

EVERY passenger provides his own motive power in one of the world's queerest ferries, spanning the River Aidd in Yorkshire, Scotland. Sitting in a device like a boatswain's chair, suspended from a stout cable, he propels himself across by turning a trank.

The spring-steel device, freed inside a Worn partue, restores its original shape

SPRINGS RESHAPE PISTON

Worst aluminum pistons in auto engines may be restored to their original fit, it is said, by the use of new piston expanders. When one of the spring steel devices is fitted into the intenor of a piston, and its retaining clips are withdrawn with a screwdriver as shown, pressure at ten points expands the piston.

WithLING screws clear the payement of snow in a snow plow completed for use in California this winter. It will be put into service to keep open the Lassen Peak Loop Highway, which hitherto has always been blocked by the first heavy snowfall of the wanter. The acrews of the new plow clear the way while the machine proceeds at fifteen miles an hour and as a result it is able to clear any ordinary stretch of rondway in a remarkably short space of time in comparison with hand labor,



Sitting in this seat, anapended from cables, a passenger ferries himself across the river

Timing Camera Splits Athletic Honors



bize both Metcalfe and Tilan as co-headers of the record—an act on tarprecedente ! in the athletic world. It also voted Mea Evelyn Hall co-holder with M fored Didrikson o the cights a sp by the a er sir camera showed that there was not a bun-Gredth of a second to choose between them. The two-eyed camera had its inception in an incident of several years ago when G T Kirby former president

of he Amateur Athletic Union saw a

movie of an in ercol enacte race and reas-

ized that second place should have been

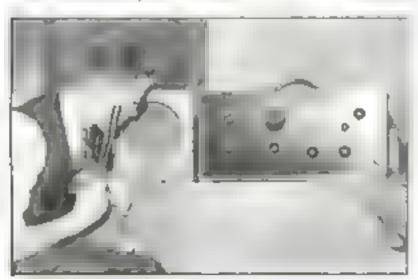
warned to a man not even piaced by the sunges. He enlisted the all of the Heal T epitione Laboratories in developing a timer not subject to human fallibility. graphs both the participants finishing and the time of each picture an shown by the dials. Because of its extreme precision due to the fact that didls of the timer, connected to the starter's gan begin to revolve at the hammer's click, the new camera is now being used of the air

ture camera capable of taking 128 pr

tures a second and a set of electric clock

1 5 5 5 6 11 5

dials registering time accurately)



BUZZ LURES MOSQUITOS TO DEATH

some day have its electric "de-skeeterizer"? Female mosquitoes burn to attract the stingless, silent males, and experts of the U.S. Public Health Service have just completed an instrument designed to duplicate heir droning sound. Resembling a radio set in appearance, it produces a loud hum or adjustable pitch. Thus

Will the complete hume the experimenters hope to lure great swarms of male mosquitoes into traps. If the scheme works, it might curtail local breeding of the pests. The experiment was suggested by an incident at Lynn, Mass., where General Electric engineers were operating a powerful electric furnace, Its hum could be heard far away. Soon it was littered with the corpses of thousands of mule mosquitoes. Apparently they had flown in from marshes attracted by what they mistonk for a swarm of females.

Strange French Boat Can Crawl Out of Water

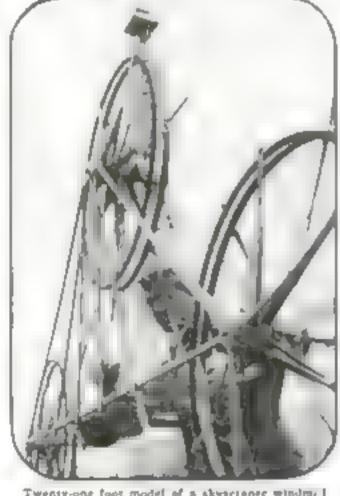


MAKES MODEL OF 1,400 FOOT WINDMILL

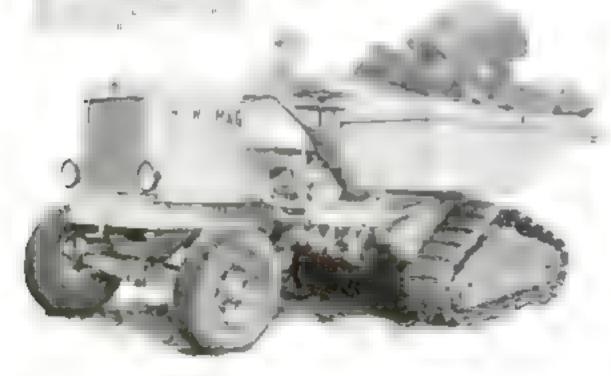
VISITORS to the coming World's Fair at Chicago will see a twenty-one-foot working model, illustrated at right, of the "skyscraper windmills proposed by Hermann Honnef, German structural engineer. To tap the power of upper-air gales, his bold scheme calls for the erection of 1,400foot towers bearing wind driven wheels more than 500 feet in diameter and capable of furnishing vast power (P. S. M., June '32, p. 21),

DUMP TRUCK HAS TWO FRONT ENDS

Without tuening around a new dump truck for road but Ing travels forward or beckward with comb rest The driver's seat reviews, to face e ther was. Dual controls are previoed and a special transmission box permits four siece sion or her direction. The Historian brow shows the och truck in use. The double crise, el mina ang 186 nec si



Twenty-one foot model of a akyperaper window I



SUPERHIGHWAY JOINS TWO BIG AMERICAN CITIES

A THUTTEN-MILE superhighway linking (we of the nation's greatest cities has just been opened between New York City and Newark, N. J. Starting at the New Jersey and of the Howard vehicle ar usual, its steel-and-concrete via bal sours a ross rivers, marshes and crossroads to perfer har spece morar rank by the route in distucks than he easier it not be a poet at Newark will ren b. New York and it top a he jet it wire steel Shown in a siseeking aerial view the \$21,000,000 highway is ease! he cames per mile ever built but the densely populated accison it serves is said to justify the expense



Air view of the superhighway of contrate and steel recently opened for New York and New Jersey traffic

NEW LIFE PRESERVER HAS TWO PROPELLERS

Timin of sea travel because of his in ability to swim, a Japanese lawyer of Los Angeles, Calif., has invented and patented a mobile life preserver frank cranks at the sides of the device turn a pair of diminutive propellers, enabling the weater to advance at fair speed while remaining treat in the water. Thus a non-swimmer may reach a nearby shore without willing to be picked up. The photograph above shows the inventor weating his odd life preserver. Note the propellers and the hand crank that operates them.

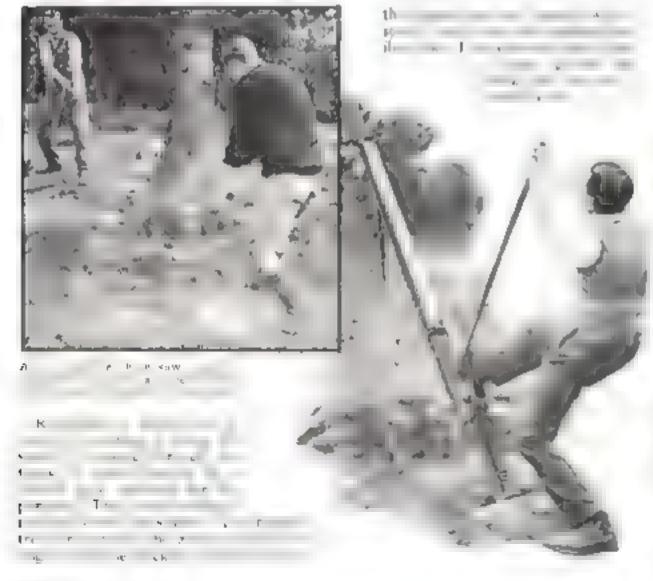
Latest Locomotive Looks Like a Box Car



How modern advances in railway engineering have altered the contours of the iron borse is illustrated in the photograph above. This is the latest type of Diesel-

electric switching locomotive put in service on British lines. Equipped with a 250-botsepower engine, this forty-ton machine does the work of eigh y-ton locomotives.

HAND WORKED JACK PUSHES TREE OVER



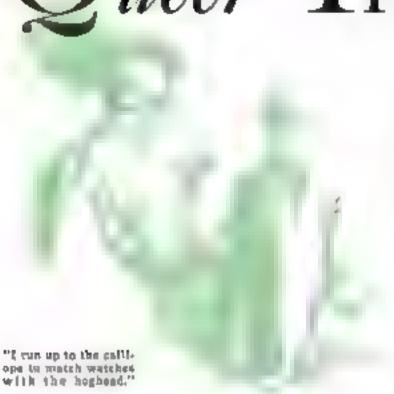


OFF FINGER RING

When a finger ring panches too tightly, or must be removed in a harry so that the doctor may treat an many, the ingenious finger ring saw illustrated above comes to the rescue. It does the job without pain or possibility of injuring the wearer. The thin lower proof is first shipped between the ring and the finger, thus serving as a guard. Then a few turns of the wing handle roll a the creater saw bade and sever the ring in a play. The tool is somable for use by jeweiers as well as with orselve or in an emergency a cayen, in can succe shall a percent.

OLD WORDS GET NEW MEANING IN

Queer Trade Lingoes



F YOU could listen to the jargon of two freight trainmen, you might hear this.

"You may not know it, Snake, but you're lookin' at a stinger that was once in line to ride the cushions. If it hadn't been for a student tallow-pot-but I'll tell you about it,

"I've got Forty-four and she's a hot shot. Before we leave the yards, I take a run up to the calaope to match watches with the hog-head, I'm surprised to find a stude smoke-agent up in the cab taking orders from the bake-head "

Is this all Greek to you? Then listen

to this transaction.

"You may not know it, yard brakeman, but you're looking at a run brakeman who was once in line to be a possenger train conduc or If it hadn't been for a student fireman-but I'll tell you about it: I had number Forty-four and she was a fast freight. Before we left the yards, I went up to the engine to compare watches with the engineer. I was surprised to find a student fireman up in the cab taking orders from the regular fireman."

An engine was obviously called the bog because of its gluttonous appetite for fuel. The engineer who runs it is therefore the nog-head. When an engine is used in the switch-yards, it is appropriately called "the goat," because it butts cars

pround

The cabouse is called the "crummy" because it is occasionally infested with truma (ace), A disabled car is "a bad order " A freight yard clerk is a "mudhop." When the engineer applies the air brakes he "wipes the gage" or they may say that he "cleans the clock."

Telegraphers' Lingo

EVEN though the telegraph operator in the railroad station is so closely associated with the railroad conductors and

brakemen, he talks a distinct trade lingo of his own. Listen to him commenting to a fellow operator upon the performance of the telegraph man in the next COWN

"He uses a bug, but it tuns away with him. As a sender he's a lid He can't read ahead and has combinations. But when he copies, no stuff is too fast for him. Last week I pasted him good, but I couldn't put him under the table. You never hear from him after he signs up."

Translated, this queer language means: "He uses a semi-automatic key, but keeps it adjusted at a speed greater than that at which he can manipulate it properly. As a sender of messages he is pour He fails to correct obvious typographical errors in the text before him, through lack of ability to read beyond the word he is entaged in sending. And he runs tocerber certain characters, which makes them easily misunderstood. But when he receives messages, no speed is too fast for him. Last week I sent him something as fast as I could, but he was always able to keep up. He never interrupts for repe-

> titions after he acknowledges his presence at the bo graning of a messagehers receiving "

> Votice how many more words are needed to say in dictionary English what the op-

erator's stery tells so concisely. Trade lingors are short cuts and time savers.

This tendency is carried to an extreme in the occusional use of bigures. Thus "30" indicates the end of a shift or of the day's work, and has come to mean, also, death. One ge s 50 or is given it. To the elegrapher "73" means "regards" or "best wishes," and "88" conveys "love and

The telegrapher's typewriter is called a "mill," and a sheet of the receiver's copy-paper, or a number of sheets interleaved with carbon, is a "book." An operator who postes up the message on a blank form from strips of tape from the automatic printing receiver is called a paper hanger,"

Abbreviations pass for some words. thus, "dux" for "duplex," "mux" for "multiplex," and "peter" for "repeater," short cuts that save them time.

Ham Jargon

IF YOU aren't one yourself, you need to be told that a "ham" is a ratio a na teur Since his language is generally alk-i. via the air in dots and dashes, he has been driven to cut everything down to the



hones, "Did man" hecomes OM "young lady," YL "nothing daing," VD, "see you later CUL; and "Ane husiness," FB When he meets his hams face to face, they will still

converse in the same code language. Thus, one "brais-pounder" might tell another

"I couldn't get on the sie last night, nursery QRM (interference). My kid had a cough that sounded like sixty cycles on the plate, and I had to go for the doc to

do some trou de-shouling

Pieces of apparatus are called by nicknames or abbreviations, or manufacturers' type numbers. Vacuum tobe becomes bostle"; rheostat, "theo"; head phones, cans"; and resistance box, "stove." The sending set is often given a feminine name of endearment such as "Old Berry," It is never masculine, QRT is "shal up." QSA is "loud," or "loud-mouthed." To hold two-way communication is "to work One amateur speaks of another's "6s" as "in the mud," when his sending techrique is careless and sloppy

Under the Big Top

ONE of the most colorful langues talked in America is spoken by the circus. If you should get a job in one, you wil, at once be called "First of May," the nickname of all newcomers to the ranks.

THIS ARTICLE THILS WHY ...

An engineer is a hog head A new circus hand is First of

Electric carrent is hot stu-A yard sweet-man is a snake A circus e ephant is a bull

A tast freight train e a hor shot

A movie electrician is a gatter. Circus monkeys are old for-A treight yard clerk s a may hop

A circus performer is a hoker



Drawings to he p you trans ate trade jargon into Eng' 16.

If you are lucky enough to make friends with an old trouper, he will be glad to educate you.

"Listen here, First of May!" he might



say, "Let the wise you up on 'mud opera patter?' You was just a gille last week. (Town person) Now you've joined out with the gypsy camp, Taik like you had! Don't go

spating giline-talk all over the lot. Them ain t zebras, oscriches, hippos, camels, hyenas, monkeys, and elephants. They reconvicts, big turkeys, hogs, hamps, grave-tiggers, old foiks, and bulls. It am't the side-show and the menagene tent. It she kar-snow and the cat-house. When

Workers Coin Original Phrases as Short Cuts in Giving Orders or in Describing Features of Their Jobs

BY GAYLORD JOHNSON

we make parade, the band doesn't play cornets, clarinets, and tubas. They play frying pans, gob sticks, and buil horns. The brass and snare drums are big tub and little tub, the cymbals are pot lids, and the drumstick is the potatomasher. The band leader is the boss wind jasumer."

As your education in circus lingo proceeded, you would learn many more new terms for familiar things. If a trouper remarked, "Flag's un on crumb casile!" you would know that it was time to eat in the cook-house. If the carcus made a long daytime rail jump, to that the couk-house couldn't be set up you would be handed a box-lunch called a "dukie" Such a Irip is dubbed a one or two dukie run, as the case may be.

yeople who don't buy tickets to the big show, preferring merely to enjoy the free sights on the lot of their right name—of fleas." You would call any performer a "finber" and any bareback riding horse a "rosin-back." A horse condemned to die for the fleas. It is a Name of the fleas.

valo Show horses are ting stock

work-horses, "baggage stock."

On a sweltering bot summer day you would say, "It's a great jucce day!" You would get used to "getting up in a tunnel." (Starting work before dawn.) You would also know what the "equestrian director" (not the magmaster) means when he says, "Give 'cm Brown's cow'" (Cut the program short.)

A Lineman Talks

If WE seek some country madside on a morning when a gang of telegraph finemen are arriving on the job, we shall bear an entirely different kind of lingo

A lineman is a "biker" But he must begin at the bottom, start as a "grant" or ground man. From this lowly job, he may use and "win his spurs," that is, become a "pole-biker," wearing steel climbing irons. On top of the staty-foot "sticks," be must then learn caution in handing the "hot stuff" or live wires. He must also beware of "Maw Bell" (telephone) wires, for they are "grounded." If his body gets booked-up with them and the "hot stoff," he will be burned or killed in mid-air. He is safe only as long as he

'stays in the clear.' that is, handles only one hot wire on a pole.

Here is a line gang arriving on a job. Lasten to them a moment. The boss says.

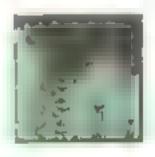
Shorty, you and Jim take that stick (climb that pole, and hang that 15 k V A. pot (transformer). You can have Harry and Jabs for grunts. Then you take the grunts and frame, roof and set this other stick, (Cu. the top of the pole on a bevel, make a mortise for the cross arm, and set the

When the pole is lined up properly in the hole, the boss shouts, "Live her mud" and the dirt is tamped in to hold the stick in place. When the rain stops their work, the men in under a tarpaulin and "hald high lines" in other words, tell tall stones of their alleged former experiences in building lines in record time, or other neusual accompaishments with the sticks

Oil Fields Chatter

A WORKER on an oil drilling gang, exchanging experiences over his disner path would be y

I was working in a post-hole termory with a mail pouch outfit. They was a sheep-herder a prine-picker and a long-hurn We cuts the ditch to 2 000 when she comes in and runs



barefoot, until we have to bean her Later when she stops flowing we puts her on the beam and she sands up on us."

This is oil-field code language for the following narrative

"I was working in shallow production oil land (with wells less than 2 500 feet deep) with a gang using a cable-drilling machine, (Called Mail Pouchers from their widespread use of this brand of to-bacco.) There was a man from Wyoming, a Californian, and a Texan. We drilled the well to 2,000 feet, when it started flowing oil. It can without any lining in the part of the bore passing through the productive oil sands, until we had to put in a plug with (Continued on page 98).

Magnet Finds Lost Locomotive

Steam Shovels Salvage Big Engine Buried By Flood

> OST-e 373,000-pound locomotive! One of the biggest freight engines in Pacific service vanished, a few weeks ago, from a siding at the little way-station of Wood-

When a mountain cloudburst

Railroad officials recalled that a Los Angeles engineer, W W Galbraith, had auccessfully used a magnetic needle to find electric ransformers buried in a Cal forms dam disaster some time before He was commissioned to find the locomotive, Walking along the stream bed with his needle in hand, Galbraith stopped at a point where it pointed straight down, apparently attracted by a mass of buried ton Steam should uncovered the locomotive of een

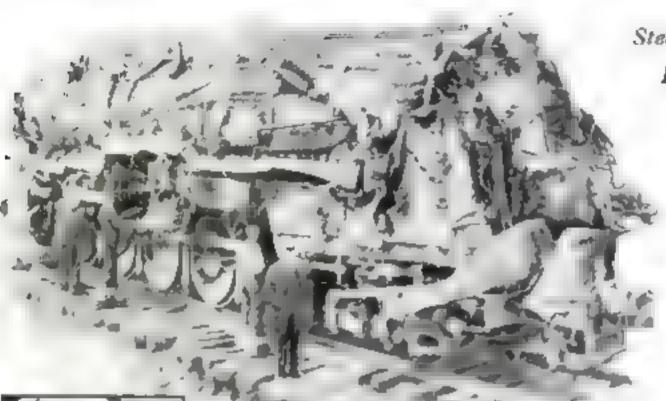
enough to justify a salvage jub-that cost \$35,000 and is consulered a master feat of engineering Track crews under the direction of H. S. Wall, the line's mechanical superintendent, built a thousandfoot spur to the spot where the engine lay. Two wrecking cranes hoisted the locomotive to a cradie and dropped it on the spur, whence it was towed in to the home shops

ford, Calif

sent a wall of water roaring down the ravine of Tehachapt Creek, the crew of a freight train in charge of E. B. Brooks, engineer leaped just in time to save their lives. The embankment crumbled before the onslaught of the swirling waters. A second later, the locomotive toppled into the ravine. Watchers on high ground saw it humped along like a chip. then disappear. When the fluod had passed a fresh-laid bed of nit covered the stream bed and the engine was nowhere to be seen.

feet below the surface.

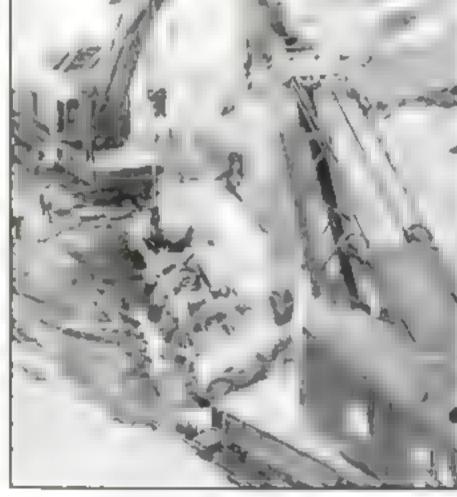
The big engine seemed valuable and repaired for service





As a resemble of three life. as down embankment when where form a king a set of a s

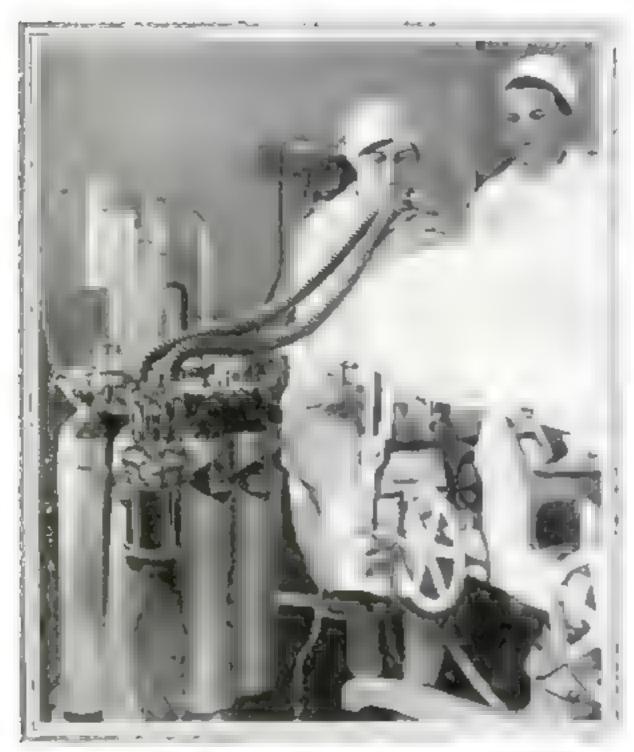
At the st constant As P Jorkel w . . sca . 0.084.0 given were many on while now will to the second of the second







Safe Pain Killing Drugs



SAVING THE ANESTHETIC Here is the very latest mechanical means for admin atering an anesthetic. Through one of the heavy tubes going to the parents amough flows the pur field gas which is inhaled. As the parent unbased, the gas laten been began into the other tube and in pur field by possing through a soda time contained to it can be used again.

ERE are three dramatic r. ws-flashes from the world of aston shing, modern surgery

In a New York haspital, a patient is wheeled into the operating room hooding a newspaper in one hand. All during the operation he calmay reads the news. He is completely conscious, yet he feels no pain.

In Pennsylvania, a famous seventy-yearrid surgeon performs a major abdominal operation upon himself, his brain alert his hands skillful, yet the lower part of his body deadened to pain

On Long Island, a patient carries on a conversation with the surgeon during a forty-five-minute operation in which his skull is opened and splinters of hone re-

moved from his brain

Amazing? Unbelievable? These are only scattered examples of the bewildering achievements of the newest anesthetics. It is no longer necessary to lose consciousness during an operation. You can remain awake and still be entirely free from

pain. Or, if you prefer to go to sleep until it is over, late developments in technique increase your safety while under the anesthetic

The story of deadening the human body to surgical pain goes back thousands of years. Enyptian surgeons along the Nile bit patients on the head in just the proper place and operated on them while they were unconscious from the blow. In the Middle Ages, powerful thumbstrews clamped down on nerve-trunks to paralyze a limb during amputation. Vapor from sponges containing lettuce, opium, bemlock and other drugs was employed in the Fourteenth Century to stupely patients. Then, in 1776, Anthony Mesmer attamed fame in Paris by hypnotizing sufferers before they entered the operating room. But the most frequent method of preparing a patient for surgery, even up until less than a century ago, was to give him alcohol until he was intoxicated. Then, while four powerful men held the

BRING NEW ERA IN Surgery

writhing victim, the operation was performed, abviously under difficulties.

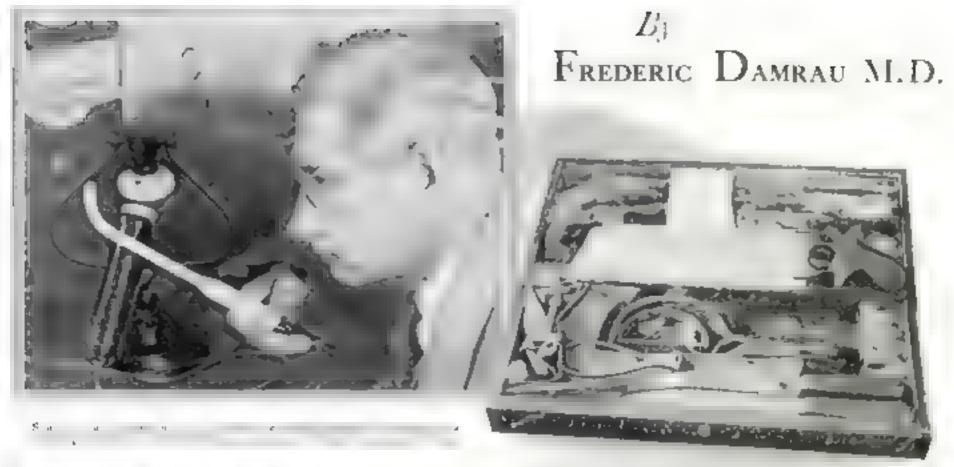
Under such conditions, delicate work was impossible. Major operations were out of the question. The chest, the head, the abdomen were virtually unexplored territory, from the surgical viewpoint, until after the introduction of anesthetics. Only then did the surgeon have at his disposal sufficient time to attempt the marvels we now associate with surgery—dramatic feats like the following recently reported from the middle west.

A beautiful, six-year-old chied of er an accidental fall, was attacked by fits. Doctors were unable to effect a cure; special ista could not discover the cause, ordinary diagnosis failed to reveal any obstruction or clot upon the brain. A great surgeon was called in. He began his work like a detective searching for clues, Noting that the contractions always began at exactly the same spot on the child's face, he prepared for an unusual operation

Near the rear of the skull, he made a small opening and then gently touched the brain over a gradually undening area with an electric needle. Each time the needle came in contact with the gray mass of nerve-cells, a quick contraction of the muscles resulted somewhere in the child's body. When this contraction took place at the exact spot where the fits began, the surgeon examined the interior of the skull near the spot at which the needle then touched the brain, He found a biof scar tissue, When it was removed, the patient made a complete recovery. But for the snage of modern surgery, the child would never bave been normal again.

That operation required nearly an hour to perform. Less than ninety years ago

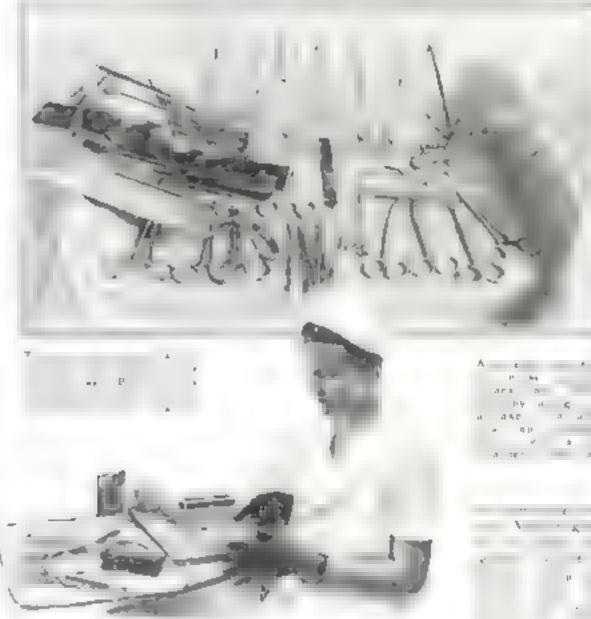
This Article, Third of Modern Surgeons,





tion. Finally I regained full conscious ness and looked at my watch, I had been insensible between seven and eight min-1. FP3

Two weeks later came the dramatic moment at the General Hospital when he demonstrated his discovery The operating foom was high up under the caves of the building It had been located there so



the patients in the wards below. The assembled doctors were skeptical. Many openly expressed the opinion Morton was

Another dentist had previously tried to demonstrate an anesthetic had failed, had been hissed out of the same room, and waughter charges Yet be went cou-

screams of the suncters would not disturb trageously ahead. At the close of the micresulul operation performed by Dr. John C. Warren, this famous surgeon turned to his coileagues and said in a husbed

"Gentlemen, this is no humbug"

Two years later, chloroform was introduced in Europe and not long after, he from oxide, or laughing gas, came in o use. The foundations of painless surgery had been laid

While chloroform was widely used in Futope, it was never popular in the United States, Carried by the red blood corpus-

in Our Series Dealing with Achievements Describes Many Recent, Amazing Operations



he ration netruments into which a fully the instant an incident the would in its ly blaminated with no observing abadems

SEMARKABLA MSTRUMENTS USED BY SURGIONS struggle. Accoholics are particularly susceptible. I remember one giant longshoreman who was six feet and a half tall and accustomed to drink whiskey like water. I thought I had him safely under the abesthetic when he leaped off the operating table, buried me half across the room and was pummeung me unmercifully when orderies rushed in and pulled him off

The general rule is. The stronger the patient, the greater the excitement during the second stage. Invalids, who have been contined to hed for long periods require the least area bette and women are usually

casier to anesthi aze the

A few years ago, a who stood more than six feet tail and weighed 300 pounds, had an acate attack of appendicate on the Agastroia at three A M during a feer he stoom at sea. Whi notes was rushing the length of the deck

cles. It reaches the brain is disclosers the cell which record pain sensations. The conner is the even a latter con much in the blood stream may haraly so the heart

I remember one cast in which a patient a heart ictually stopped during an operation I was performing. It came he a banderbolt out of a buse sky. As the id name later de in a lt, the patient I is coal black. I saw-white, Unit spatient.

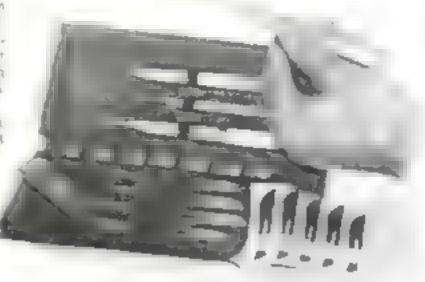
second emergency

measures saved his life. That was the last operation I ever performed in which I used charoform as the anesthetic.

THE only time I have seen chloroform used in an operating room lately was in the case of a short, thick-necked patient who was a heavy user of both tobacco and alcohol. Ascoholica are always hard to get under the anesthetic and smokers have to quit smoking for from one to two days before an operation to rest their throats. Otherwise, the ether may burn the membrane and cause cougling. In this instance, the doctor administering the anesthetic first tried nitrous oxide. It proved unsatisfactory. He tried ether, Violent coughing was the only result. In the end, he had to use chloroform to get the patient under after which ether was employed for the remainder of the operation.

The effect of other, the most widely-used anesthetic, is aimiar to that of alcohol depressing the brain. It produces a deeper intoxication than alcohol but one which does not last so long Laughing gas, or nitrous oxide, brings unconsciousness by combining with the red corpuscles and preventing them temporarily from carrying enough payen to the brain

In present anesthetic technique, nitrous oxide and oxygen are used until the patient has lost consciousness. Then other is administered during the hardest part of the operation, finishing off with nitrous oxide again. Less atomach disturbance results that when attraight other is employed. Nitrous oxide is the safest anesthetic; older aform the most dangerous but the most efficient, other the best for all-around work.





Delicate angues instruments are provided with removable hisdan as shown at the ef-Above, even the blades on sciences can be changed, a new one sixting on in a groupe

Because eiber is an intoxicant, the human system develops a tolerance for it just as it does for alcohol. The most extraordinary instance of this sort is the case of Capt. Albert Froidevoix, a furly-two-year-old French soldier of the Foreign Legion. With a total of fifty-five operations, he holds the world's record.

Twenty years ago. Frosdevaux was cutting down a potson bamboo in French
Indo-China. A small sliver entered one
finger. A week later, the finger had to be
amputated. Gradually, the mysterious poson seeped through has system necessitating operation after operation, until today
arms and legs have been completely cut
oway. As a result of his many trips to the
operating room, his system has become
so used to ether that three times the ordinary amount is required to make him lose
torscrousness.

IN ADMINISTERING ether, there are four stages, each with its separate problems. In the first the patient is sumulated. His breathing becomes deeper. The pupels of his eyes grow larger At this time, the amount of ether must be regulated carefully. Too much will burn the throat and result in coughing. Patients who wear beards require special masks to prevent air from leaking in around the bottom of the ether cone and interfering with the action of the anesthetic. The way to go under an anesthetic with the least difficulty is to breathe rapidly and deeply

During the second stage, the patient becomes excited. He may shout or sing of strashing sur-inch rails and bending steel plates forward of the chart room, when the chief surgeon, Dr. B. Sydney Jones, decided to operate.

PRACTICALLY everyone on heard was seasele. With half a dozen volunteer helpers, Jones strapped down the huge patient and administered the ether. Then, one by one, the assistanta staggered away, attacked by seasekness. Fortunately, a sufficient number remained to restrain the hig diplomat during the excitement stage but, when the actual operation began, Jones was left with a single beloer. In spite of this, he completed the operation successfully, and later, when the diplomat returned to Europe on the same boat, he thanked him for saving his life.

The excitement during the second period may be increased by an inexperienced surgical team, through the patient overhearing something said after be is apparently unconscious. Quiet should be maintained until the third stage is reached. Some anesthetics make bearing particularly acute. With introus oxide, for instance, the sense of bearing periods after right, smell, touch, and taste have been lost

In the latter part of the second stage, the muscles become relaxed. The breathing grows regular, machine-like, averaging between twenty-five and thirty inhalations a minute. Patients perspire freely. In some hospitals, the ether is passed through a bottle filled with hot water before it reaches the patient to keep the vapor from chilling him. [Continued on page 102].

Life of Atoms Shown in Movies



You see a machine gunner pull his trigger and a hail of builets pounds a beavy steel plate. A gage needle behad the target swings over and slays there held by the force of the rapid succession of impacts, until the Justlade stops By this vivid analogy, one of the films illustrates an otherwise difficult concept—how individual morecules of gas, bombarding he walls of a closed vessel, create a steady pressure by the cumulative force of their impacts. Similarly other traits of atoms and molecules, difficult to describe in words, are made uncerstandable, with the aid of microscopic and time-lapse photography animated drawings, and comparisons with familiar objects

To idustrate "oxidation," the second film brings a forest fire into the room. A plowtorch burns its way through steel plate. The operation of a coke oven is shown, The rusting of metal is explained as still another example of oxidation, a chemical process not limited to actual burning. Sometimes the process can be run in reverse, then chemists call it "retluction." Thus the film shows how from rust can be turned back again into pure from by placing it in a glass tube above a battery of burners and blowing bydrogen gas over it. Proof of the feat of chemical sleight-of-hand is given when an electromagnet, which will not attract pieces of rust, picks up the fragments of fron-

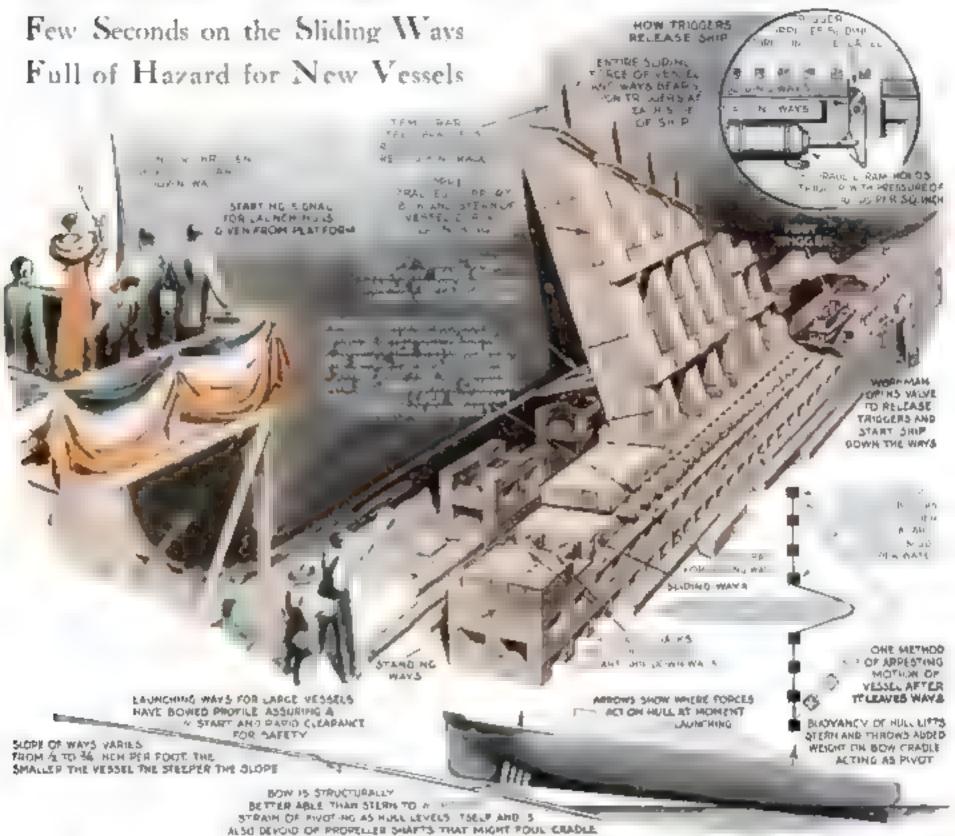
In circle from rust is changed back to from so magnes are says at Above hydrogen atom as forty bull north, led by its vague a und

Scientists bail the films as a new, vividway to teach the fundamen als of natural law. University of Chicago science classes. have already adopted the two movies as part of their regular courses. Other schools and universities are expected to follow their example. One of the ten-minute films is said to take the place of a lauoratory demonstration requiring two hours or more of classroom time-in add non to two or three hours of preparation, always with the worry that some part of the demonstration may go wrong. Small codeges with limited staffs will benefit especially by the inhovation, according to Col. F. L. Devereaux, vice-president of the Western Electric Company subsidiary that produced the films and plans their distribution.

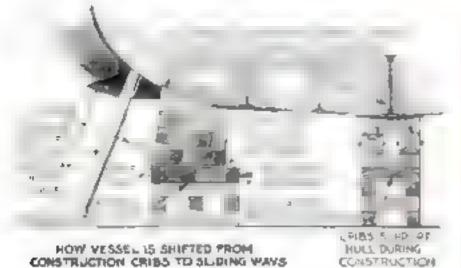
Pictures such as these, their sponsors believe give an audience an unforgettable insight into the behavior of matter. When the best idea scientists can give its today of what an atom looks like is a "fuzzy bail," a layman can bardly be blamed for understanding only vaguety. The new films visualize how atoms in the aggregate enter into every man's personal life. The way the unety-two varieties of atoms are grouped into molecules determines whether a substance shall be water, iron, or fiesh

and blood

How BIGGEST SHIP



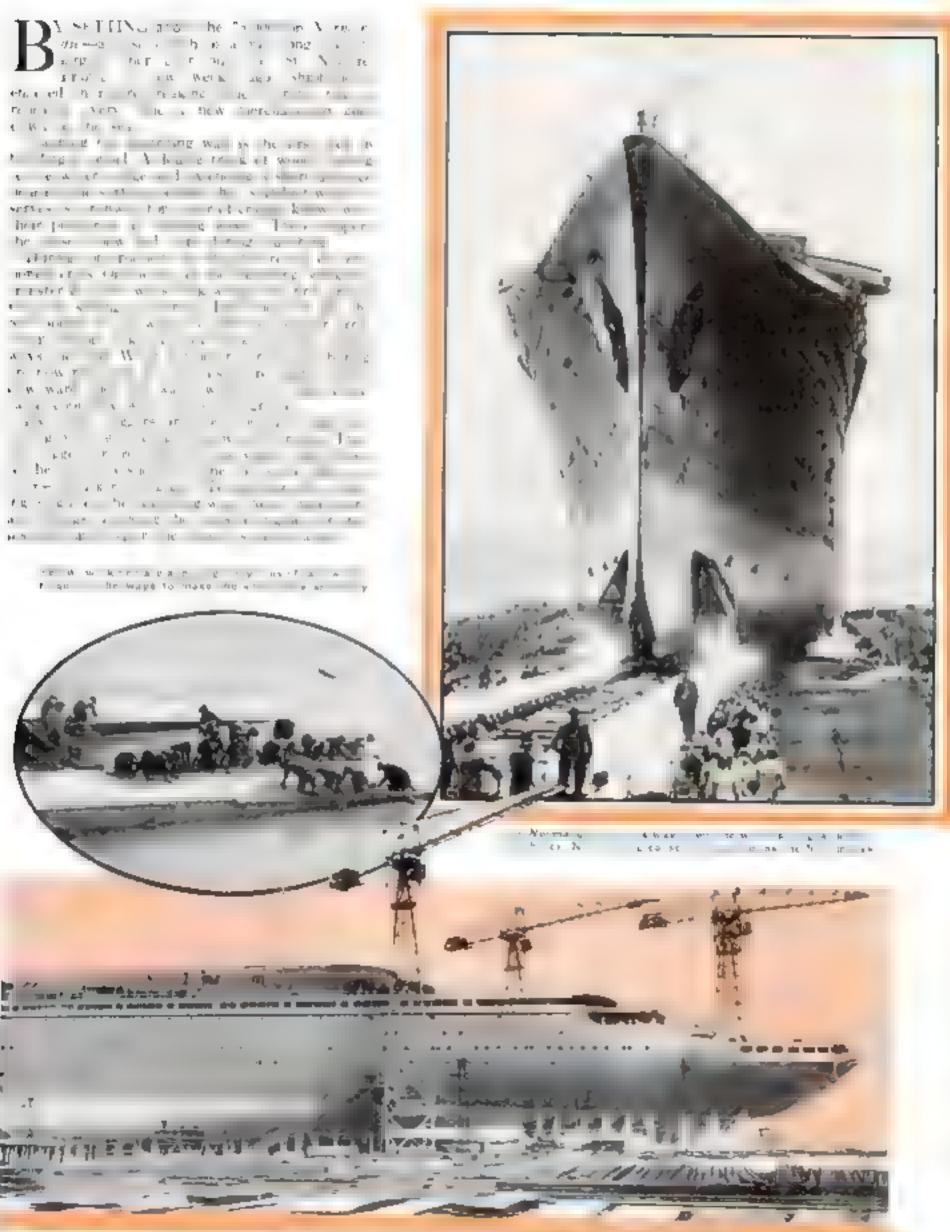
WITH SHIPS ARE LAUNCHED BACKWARDS



ALL READY to take the initial plunge. The 1,027-foot hull of the Normandie, the biggest liner ever built, is shown at the right just before the oak wedges transferred it to the sliding ways preparatory to starting it for the sea



Was Safely Launched



uncle sam's Save Farmers Secret agents Save Farmers

Reports from All Parts
of the World Center in
Our Nation's Capital

B Walter E. Burton





most of Agriculture hand two keys to unlock the bon in which truly type is are east

DEVASTATING drough visits a part of Southern Russia, injuring wheat too other farm trops, while winds and floods inflict further damage in other sections. From still another area omes the news that wheat rust is causing more damage than the sanguine growers had anticipated.

Not long afterwards, a farmer in Kansas tilts his chair back against the wall, lights his battered pipe, and listens while the voice from his radio tells him that the Russian wheat crop will not be as large as expected, and that American wheat, as a result of this, may find a little better market than he had thought possible

Between these two incidents is a picture that for speed, mystery, and escitement, rivals the gathering of news about a world-shocking murder or kidnaping. It is the picture of Locle Sam, star reporter and operator of the largest and fastest farm news-gathering organization in the world

Ac avises of the crop and livestock reporting service of the Bureau of Agricultural Economics, U. S. Department of Agriculture, daily influence you and everyone else in the nation, for they affect the prices that you pay for bread, cotton

shirts and dresses, beefsteak, wool suits, and other necessities

Crop and livestock reporting was deve oped to its present state of efficiency chiefly as a result of the demands of tarmers and farm trade agencies for information concerning crop conditions, especially just before market time. If a grower of com knows, early in the season, just how much will be produced in the I mted States and other countries, he has a fairly accurate idea of the prices he is akely to get for his products. If he were kept in the dark about the corn setuation in general, a crafty buyer might cheat him by making him believe that there was an oversupply of corn, and therefore that low brices prevailed

Like a giant spiderweb, the communication lines of the crop and livestock reporting service reach to all parts of the earth where information of interest to American producers is to be found. Foreign outposts of the system are situated in London, Berim, Belgrade, Marseilles, Shanghai, Buenos Aires, Pretoria, (Umon of South Africa), and Sydney. In each of these branch offices are from two to six trained crop experts who collect valuable information and relay it to Washington.

by the juicker means at the recommend.

Has be most excess to news gather in system danker me ented States. The headt warters offer is of course at Washington—in a brand new building of the Department of Agriculture. There are field offices, telegraph stations, and field agents at important points. These perform the double duty of gathering in formation and distributing reports and summanes from headquarters and other sources.

Speed is of first importance in the matter of farm facts that will affect marke, conditions and prices, so the government main aims a leased-wire telegraph network as complete as that of many other newsgathering services. It is the only government-operated system of its kind. There are about fifty-six offices connected by nearly 11,000 miles of lines, and requiring the services of seventy-five to eighty telegraph operators. In addition, there are several hundred miles covered by telephone and by radio telegraph service.

Information codected and reciscible ed is obtained largely from farmers. More than 300,000 farmers turn in reports of their crop acreage, livestock production and the like. Each state office has on its

from CROP SHARKS



TARTLING was the report given the readers of this magazine recently (P. S. M. Nov. '32, p. 27) concerning the manner in which the American government quards its crop reports, Interesting as it was, that article really put the cart before the horse. How, in the first place, are the data gathered from which the reports are compiled? Mr. Burton asked the Director of Economic Information, at Washington, just how the information is secured. This article is the answer to that question.

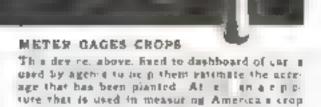
staff a man trained in ga bering agraciateral information, and one or more a sistants. These men keep in touch with farmers, and make personal surveys and abservations of trop conditions.

Not all farmers look with favor on the activities of government observers. For some reason or other, many think that the government reports cause damage by placing valuable information in the bands of speculators. On the other hand, specuative interests have been even more active than farmers in opposing crop reports Large concerns which purchase farm prodgets maintain their own observers. It is apparent that if the farmer, who cannot afford to codect his own information, were without government reports, he would be at the mercy of speculators who could persuade him to sell at low prices at times when small crops really created high-price conditions.

The gathering of farm facts goes merrily on year after year. Several ingenious mechanical hespers are used for a portion of the crop estimating. One is a crop meter attached to the dashnoard of an automobile which is driven along roads adjoining cultivated fields. The meter is operated by a speedometer mechanism

Buttons are pressed to record the footage of corn, wheat or other crop

For example, crop meter measurements have been made in several cotton-growing states for providing a check on acreage changes. Meter-equipped automobiles are driven over the same routes each year and the road front footage of crops measured. Variations in this footage from year to year give an appreximate indication of variations in the number of acres planted. From 2 000 to 5,000 miles of



ares in an effort to verily the data received

CROP REPORTS RELEASED AT THREE O CLOCK

couter ace covered in this way in each cotton state.

Another way of checking crop acreage is by watching fertilizer sales. In cotton states where fettilizer is bagged, records are provided by tags attached by the state fertilizer control officials

Of the various methods used in coder ing facts, no one way is absolutely certain but by checking one against the other 14e crop experts can arrive at a fairly definite estimate of conditions

Such information, no matter how ob-tained, immediately becomes more valuable than gold-if gold can be compared with acreage figures. If you think that the army or navy represents the last word in secrecy where (Continued on page 90)

New Products Hasten Return of PROSPERITY

How Inventors' Activity Is Swelling the Growing Tide of Business

statement been made that prosperty will return through the appearance of a great new invention which will create a new industry, but as the development of the automobile, the movies, the radio, has added billions to the national wealth of the Loned States in the past

During the last half century. American prosperity has grown by leaps and bounds as the result of American inventive genus. The telephone, the phonograph, the cash register, the arriane, the safety razor have literally created out of one great new industries which have played a leading role in the nation's industrial advance. The rise of such incustries has often been a key factor in the return of prosperity after a period of depression.

A careful study of present-day inventive and incustrial activity, however, shows no such revolutionary development on the horizon. No single invention appears likely to bring an end to this depression. Instead, the next few years will see the return of prospectly through the appearance of thousands of new and improved items, each contributing to the tolal volume of augmented business.

A comprehensive survey just completed by Postland Science Monthly, shows this beyond a doubt. Covering thousands of manufacturers and al. parts of the country it reveals that an overwhelming percentage of the concerns are placing new and improved products on the market. The data show manufacturers have done more to improve their products in the last two years

than in the whole decade from 1920 to 1930. It shows that more new products have been devised and more neglected inventions have been put on a basis of actual production during these two years than at any similar period in all history. Out of this practical action and proneering

PREPARING FOR THE RETURN OF PROSPERITY Yankee ingenisty and plagress is manifectures are saying the foundation for the return of prospectivy. Each new product plays is part in the creasing the volume of business and a bringing success to everyone

sparit throughout America will come a new era of progress and prosperity

Prosperity depends upon the circulation of money, And, this circulation is most quickly increased by the introduction of new products so attractive and valuable the public is compelled to buy them.

The typewriter is a case in point. A bottle of ink and a pen costs, at most, fifteen cents. A typewriter costs twenty-five dollars or more. Yet, the typewriter turns out written words so much more rapidly and efficiently that millions of people have been willing to pay the extra cost to obtain the benefits of the new product,

Similarly, a best of other new Items have shown defimite improvement over exising equipment and have found a trady market. By creating a flood of new and better products, manufacturers will stimulate a tremencous operand from the busing paid;

That this is being realized is indicated from all soiles

The number of new stems being submitted for inclusion in the editorial pages of POPULAR SCIENCE MONTHLY has never been so great as in recent months, In the middle west, a New Producta Conference recently attracted representatives from industries all over the nation. The problems of creating, perfecting, and marketing new products were dis-cussed by experts. When an eastern technical school, a few weeks ago, lovited manufacturers to send exhibits for display during a New Products Day, the response was overwhelming

A leading New York patent attorney told a representative of Popular Science Monthly that never in forty years of practice has he seen so many inventors occupied in perfecting small, useful devices as at present. The demand of manufacturers is for tems of novely one of the which all have high value and and a ready market.

The head of an eastern advertising agency declares that his clients have shown more interest in new products during the last six months than at any other time in twenty years. The research engineer in charge of a famous industrial laboratory reports that experiments concerned with the far-distant

future are being shelved while the staff of experts under his direction concentrates upon improvements and innovations which can be placed upon the market at once.

An association of more than 800 manufacturers recently made a survey of its members to see what steps they were taking for a return of prosperity. The number who were turning to new products ranged in the various classifications of the industries, from fifty to amety percent of the concerns.

Other trade groups tell the same story. When interviewed recently, the secretary of one national association of manufacturers concerned with home equipment, said

"It is safe to say that our members are marketing four times as many new produc's now as they were in 1928

The statistician of another home product manufacturer's association reported.

"There have been more new and ourproved apphances in our field during the past two years than made their appearance in the dozen years that went before"

And the head of a national group of motor car manufacturers declared

"There have been more innovations, changes, and improvements in automobiles and automobile equipment during 1931 and 1932 than there were in the whole decade which preceded those years."

An organization which specializes in introducing new products into department and chain stores has made a special check upon the number of such products appearing in different years. It has 1,500 stores in the United States and Canada as its clients. The result of its check shows that the last six months have seen the greatest fluod of small, ingenious, new items issuing from American factories that the concern has ever experienced in its entire

RECORD NUMBER OF AUTO IMPROVEMENTS There were more changes and improve-mone to autoe and auto equipment du ing 1931, and 1932 then in the proceeding ten years

history of marketing such new products.

Another company in the middle west makes a business of placing new inventions with manufacturers looking for new products in their particular fields. Recently, 336 inquiries were received from such manufacturers concerning items which appeared in a single bulletin sent out by the organization. This record number of requests for more information, indicates the keen interest and increased activity among companies in connection with new and improved products.

"Any company," a noted industrialist told several hundred manufacturers at a convention not long ago, "which does not keep up its product development is riding for a fall."

Industry is awake to the fact that it is

the new, the novel, the improved product that will sell today. The following is quoted from the official publication of the leading trade association in the United States.

"Industry may have slowed down its production, business its pace But there is no slackening of interest among business men in new and useful products and processes."

Despite the depression, the flow of new products and processes in industry continues unabased. To them, many established companies are turning in an effort to put idle plant expanity to use."

How necessity has proved the mother of invention and the manner in which depressions have increased the number of intents applied for in the just is shown by a glance at the records.

The Silver Campaign Depression of 1895-7 showed a marked increase in the number of patent applications received. Similarly, the Rich Man's Ponic of 1903-4 showed the largest number of applications ever received up to that time. Again, the Panic of 1907 brought in the largest number of applications up to that year and the depression of 1911 showed a jump of 5,000 applications as a result of business s. gration. But, most striking of all, was the increase which came as a result of the Primary Post War Depression which occurred in 1921 and 1922.

However, the number of new ideas finding their way from the workshop and ishoratory to actual production in factories and sale in stores is greater during the present months than during any previous period of depression

hankee ingenuity and progressive manufacturers are laying the foundation for the return of prosperity

A glance at the patent records of the world gives an interesting stdelight upon the relation of improved products and prosperity. It is not just a happen-su that in the United States, where wearth has increased most rapidly, it nove ors have been most active. From the beginning of the patent records in each country to the end of 1930, the totals in the four leading nations are \$25,382 for France, 754 -054 for England, 531.681 for Garage and 1 797,380 for the United States. The seventy foreign nations which issue patents have a grand total of 4 395 493 Thus, busy American inventors, alone, hold more than one-fourth of all the patents in the world

With more than 100,000 American manufacturers alert for new ideas and watching for improved products which they can add to their lines, the tide of newly-marketed items is steadily rising. Each new product, with greater eye or utility appeal, plays its part in increasing the volume of business and in producing prosperity for all.

While the general public watches for some spectacular single invention to pull the country out of the depression, thousands of small, unnoticed, useful innovations are lifting it toward prosperity,

PLOOD OF NEW PRODUCTS. During the case as months the greatest flood of small, agentous new clams has smoot from American reclaims that was ever superiored by this country



Car Thieves Stopped by Exploding Shell of Gas or Smoke



Demonstrating is new means of protecting autos from thieves. As the car is started, a carridge automatically releases a ther irr taking gas or smoke which forces the thief from the wheel

GIGANTIC INSULATOR HAS TRANSFORMER INSIDE

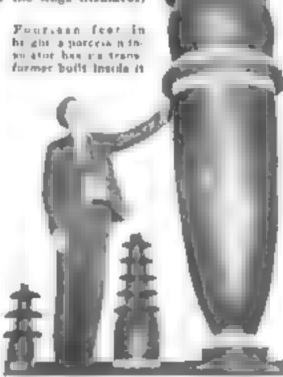
Smoke cartridges may be used instead of gas if deared. They are less persions to an absent-minded car owner who may forget to detach the anti-theft mechanism when he returns to his parked auto.

escape from the sufforating fumes.

Wor to the car thief who attempts to steal a machine equipped with the latest protective weapon! The moment he starts to drive away, an automatic cartridge discharges a cloud of gas, Overwhelmed by the fumes, the thief is glad to make his

Foregreen feet in height, a porce ain insulator, with a transformer inside .. has been developed for use on a 220,000-volt transmission line in Ohio. The result of

this odd arrangement is improved insulation in the circuit where it is employed. In addition to its electrical advantages, the insulator is considered a masterpiece of pottery-making It is fortites in two haves each having a shed of one price of celain. The photograph shows the comparative size of the huge Insulator,



ARCHITECT DESIGNS COTTON HOUSES

Hot six of corton are proposed by Law rence has an noted architect to some he low cas beasing prosters. Morels of two types, a \$1500 five room home and a week-end house have been desig/ed. A weatherproof exterior is provided by a roof and walls of firepronfed cotton ducking stretched over a wooden structural frame Inner walls are also of cotton. Insulating material may be acceed to exclude heat and cold Sin e the casseas in flexible it is anaptable to any shaped surface.



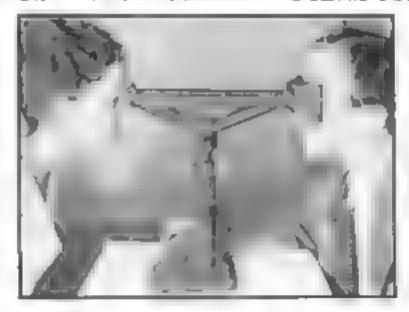
would cost \$1 500 to bu. 4

DOGS NOW NOSEPRINTED TO PROVE OWNERSHIP

TAXING noseprints of dogs to guard them against loss or theft is the method being adopted by western owners. When two persons claim the same dog in court, ink noseprints, like the specimen illustrated, settle the matter. Like human fingerprints, the patterns on the nose of the dog are said not to change with age,

and therefore a perneed submit but once to having its nosterls smeared with ink. No two dogs have identical patterns so a mistake is impossible

ODD INSTRUMENT MEASURES HUMAN EYE



To am in fitting eyegiasses, an optical expert of St. Paul, M nn., has invented an instrument that measures the exact distance between the pupils and between the pupil and the nose, Most persons' eyes are unevenly spaced, and this must be taken into account in fitting glasses, Through twin tubes, as illustrated, the examiner sights upon the patient's eyes and moves a pair of cross-hairs within the instrument until they center upon the pupus and register the spacing with a high degree of accuracy



means of the cyunder's mechanical arm.

Breakness when showing how diver operates the mechanical arms with levels pieced anade tube

ODD CAMERA LENS NEEDS NO COLOR FILTER



NEEKING & camera lens that would permit fast exposures with proper color values, V, Akers, landscape artist and photographer of Norway, Me., hit upon a nover material. Crystais of citrine quartz had been found in a mica mine nearby and Akers of a ned a crys as and had a ground in a an experimental lens. The experiment succeeded Because of the yellow tint of the quarts, Akers found he ared not use a color filter to hold back blue rays.

erator looks out or the heavy glass port-

Secrets of Frost Feathers Sought on Mountain Top



Showy frost feathers, that form in glistening spikes on buildings swept by ity winds, have lured a little band of scientists to the frigid summit of Mount Washingon, N. H. As a part of the weather observations undertaken by the Mount

Washington Observatory, they will attempt to solve the mysteries of the strange formations. Little is known about the way in which frost crystals are formed. They do not resemble snow crystals. Feathers that they form may grow as long as three feet, growing to this size in the space of one cold and windy night. The striking photograph in the circle is of a frost feather formed in this way. Such feathers indicate the direction of the prevailing wind at the point of observation.

EDISON'S TUBE GETS RADIO PROGRAM





A vacut M tube was devised by Thomas A. Edison fifty years ago, long before the first crude wireless sets were dreamed of I roof of its ability to pick up a modern radio program was given the other day at a New York broadcasting studio. Music broadcast from a small transmitter in the studio was tuned in on a receiving set using a faahful copy of Edison's original tabe, with a curved filament of carbonized bamboo and a plate formed of two upright wires. The program, received with perfect clarity, was then re-broadcast to radio listeners. At the time of its invention, the tube was regarded merely as a sciential curiosity

indicate the direction of the prevailing wind at the point of observation.

Though innocent enough in outward appearance, a hovel type of firearm disguised as a smoking pipe serves as a formidable weapon when it is needed. The gun fires a 25 cabber cartridge, its stem unscrews for loading, while the bowl of the pipe serves as a magazine for five extra rounds of ammunition. A knowled screw near the center serves as a trigger, and fires the pipe pistol when it is pulsed back as illustrated in the photograph above, the user nighting meanwhile along the length of the stem. A German inventor is

HOLDER ENCLOSES CIGARETTE

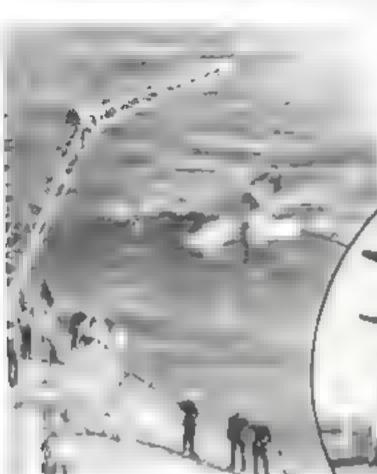
PIPE SHOOTS THROUGH ITS STEM



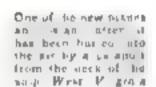
No Lenger will sparks from eigareties menace rugs and clothing if a new safety first eigarette holder of metal pictured at the left, should find favor with smokers. The user inserts a eigarette in the tubular opening, adjusts small metal laws that hold it, and lights it through an upper slot. A ouvenient ring slips over the finger for holding the device. Were screening on the side prevents the escape of sparks. Even the added convenience of an ash tray has been built into the device by the thoughtful inventor. Ashes fall into a removable receptacle at the bottom, as does the nigarette when it has been smoked. It opens readily for removal of butt and ashes.

responsible for the unusual weapon

New Navy Planes Land on Water or Deck



At Jeft, our of the Navy's new amph.bean planes in thannag up of a crane that we'd he at it on the abips deck. In the crane the plane is seen held by the crane



AMPHIBIAN Birplanes, able to land of her in the water or on the deck of an airplane carrier, are now being used at sea by the United States Navy. The photographs reproduced here were taken during resent navid maneuvers off the Cautomia case. They show the launching and landing of planes attached to the battleship lifest Pieginia. Catapults are used to launch the planes. The return of a plane to the ship is a spectacular maneuver.

With wheels retracted, the amphibian lands in the sea and taxies up to the ships and stops beneath a justical crane. The

pilot grasps the hook at the end of the housing cable, making it fast is the plane which is then swung a searly the vessel. For landing on an arrival carrier's deck, the wheels are extended beyond the pontoons and the landing is

performed in the manner of a land plane, the pontoons being held clear of the ground by the extending wheels.

SECRET PROCESS SAVES NEWSPAPERS



By present onlinery newspapers in a secret varnish-like solution of chemicals. Dr. Joseph Broadman, New York City physician, believes be has found a way to make them virtually indestructible. Sheets treated in this way are given a losser that is said to improve rather than retract from their legiblity. They remain flexible and easy to handle, while their tensile strength is multiplied about twen y times. Dr. Broadman chanced upon his dis-

> covery during a search for a way to preserve his volumnous collection of war chippings. He foresees its application by libraries, which now preserve newspapers with Japanese tissue.



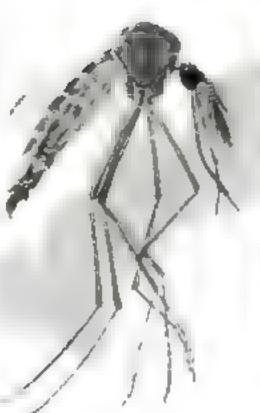
Dr J Broadman New York physician, exhibiting samples of newspapers that have been treated with his secret preberving accurring as shown at the right

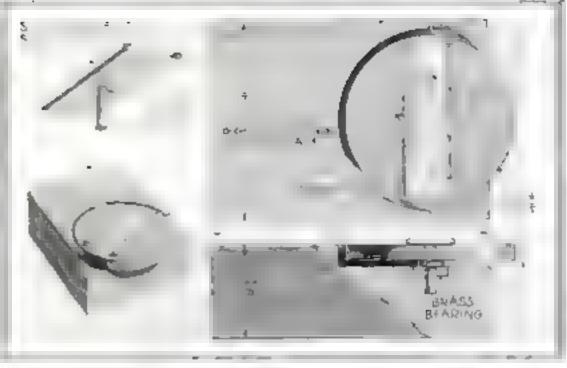


ONE DISH OF ICE CREAM NOW PUT UP IN CARTON

A NEW way of serving ice cream has been perfected by a Louisville, ky or-ventor. The cream is packaged in small round cartons holding individual size I portions. Tabs on each wrapper enable it to be removed with one hand, dropping the contents in a dish as shown in the photograph above. Special machinery has been designed for the manufacture of the new-style packages. The frozen cream, first rouled into sticks and covered with wated paper, is sliced to the proper size to fit the package.







Drawings above abow the manner of preparing a surntable for yourself upon which a glass saids is placed so that a low wail of above at each be built up to inclose apartment

Greating New Worlds

with Your

PRACTICALLY boundless and much of it still awaiting the curious eyes of those who would unravel nature's secrets, lies the world you can see only with a microscope.

Within his borderless domain, the microscopist can populate little worlds of his own making. From a scene almost as stal as death, he can create a world teeming with life. He can bring into being countless millions of tiny creatures not visible to the naked eye.

One way to do this is by what is known as a kny infusion. A few stems of hay are placed in a jar of tepid water and permitted to stand undisturbed in a warm room for about four days. Then some of the water is taken off with a spoon or a medicine dropper and a drop of it is placed upon a stide (reshly cleaned with alcohol. When this is done, we shall be amazed to find many wend creatures streaking across our vision. The scene is like a nightmare—a phantom world peopled by strange creatures.

Just as we have brought this strange world into being, so we can destroy it and its queer inhabitants. Before we commit this master crime, however, we shall need more equipment. It will serve not only for this amazing experiment but will prove useful in many others, so the time used in making it will be well spent.

When specimens are mounted permanently, they are placed between the microscope slide and a thin, button-like cover glass. These transparent covers are fastened to the surface of the slide by a special preparation applied in a circle with a camel's hair brush in the manner to be described.

To do this quickly and easily, we will need



By BORDEN HALL

Specimens, sealed beneath cover glass on a slide, can be preserved as part of your collection

Left, picture shows how an examination ad a apecimen can be made with the microscope taked. Allove, view of a plant course magnified 13 times



This phote shows menner of admining the shutter under the stage of the microscopie

MICROSCOPE

a Larn able similar to the one shown in the sketches. The base is a piece of trummed "two by four" recessed to ac-commodate the turntable proper. The reresuing may be done with a sharp knife. Of course, the base also may be made from two pieces screwed together, the toppiece being cut out with a band law or a coping saw. The solid form of construction, however, is best if the maker has the pastence,

A piece of heavy sheet brass, bent to the dimensions shown, serves to hold the specimen slide and the worker should see a r that the slide will also in and out easily. A small shaft of brass or fron, (a piece of a large had or spike will do) soldered to the bottom of the rack forms a pivot. The bearing for this member can be made from a piece of brass drilled to produce a snug fit for a shaft

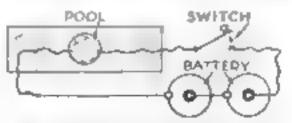
The turntable is cut from a well seasoned piece of quarter-inch wood drilled to receive the shaft, the slole boyler being fastened to the turntable with two small brads. When a small washer with a drop or two of oil is placed between the turntable and the base and a coat of shellac is applied to the entire instrument, it

is ready for use.

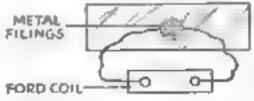
When a slide is placed in the holder and a brush dipped in shellar or other preparation is held near the center of the slide, which as revolved by bringing one finger in contact with the free edge of the turntable, a circle of shellac will be drawn on the glass. By permitting the first coat to dry slightly and adding other coats, a low wall of shellac may be built up to enclose your specimens

For the wholesale murder we contemplate, we shall need several applications of shellac so that the wall will be high enough to retain several drops of water The water is taken from the bottle containing the bay and it teems with infusoria.

We murder by electrocution and the drawing on this page makes the method clear. Only two dry cells will be needed with two timy copper wire terminals immersed in the solution. After the water is placed in the well and the wires are arranged, we focus the microscope and then watch for an opportunity. When the scene looks right and the proper number of hay water denteens are in sight, we throw the switch. Presto! Death stalks the scene with lightning-like rapidity What had looked like a crowd of people at a country fair is now a scene of utter



How connections are made to kill specirecan wholesele so they can be preserved



With this apparatos specks are made to iron filings and care displays produced

desolation. We now can study the morioniesa specks to our heart's desire

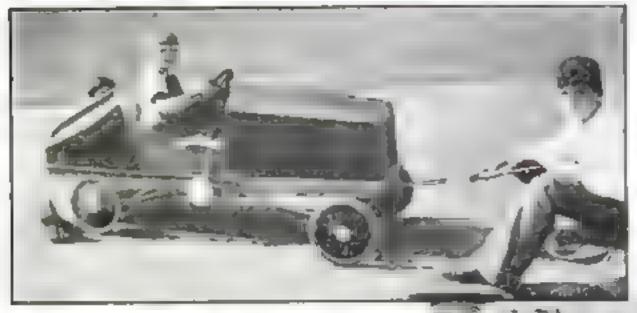
Now, let us leave the realm of biology and follow the by-roads of physics. For the next experiment, we shall need an old-Ford spork coil, obtainable for almost nothing from the junk heaps of autowrecking yards, three dry ceils, a microscope alide, and some fron or copper filings. These materials are arranged on the stage of the microscope as illustrated.

After the instrument has been focused the primary circuit of the coll is closed and a spark is permitted to play among the filings. Instantly we are tree ed to a sight that will long be remembered. Here we see a display of fireworks that will appall us and if the wires are rearranged in various positions, different effects may be obtained.

Mounting specimens for study is in it self a fascinating task. Perhaps the besobject for the beginner is a fly's wing since it is transparent. Indeed, we may start our work by preparing an interesting collection of different transparent wings-wings from a bee, a mosquito a wasp, a yellow jacket, a fruit fly, and other common insects

Specimens must be mounted absolutely dry. This does not mean that they should be placed in an oven for a few minutes, the prevaration is much more elaborate than that. For (Continued on page 82)

Midget Automobile Has Rubber Band "Motor"



Canoway for an automobile that has no engine, uses neither gas power nor man power and yet runs. The secret of the machine recen to seen on the lands are wisted to a serful runder bands. These are ed exactly as bands are wisted to ane. So much for a serful runder will run the lands are a series with the will run the lands are a series with the pull and the lands are a series with a land grouped pulley a series where is carried by two leather the rear wheels. One belt drives the carried by the for reversity that always.



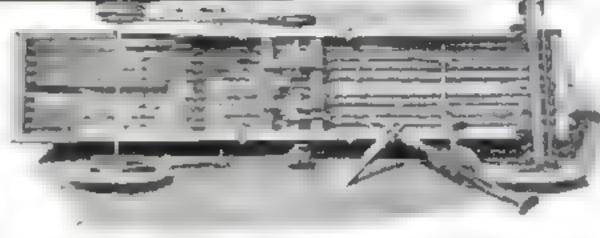


10.000 DISHPANS LIGHT WORK AT HOOVER DAM

Districted from 10,000 dishpans is the unusual engineering feat new being carned on a the sile of Hoover Dam, near Boulder City, Coio. Reflectors were needed for the powerful lights strong up in Black Canyon. Many Junds were tried and at last it was found that dishpans answered the purpose, at low cost, better than anything else. The picture shows two of these strange reflectors in use.

SKID CHAINS FOR SHOES

Penestrians need no longer slip and slide on the sidewalks, according to Bert Noblette, Winchester, Ky., inventor of the skid chain for aboes shown is picture at the right. The chains cut into the ice to prevent slipping and thus make walking safe and comparatively easy.



MACHINE MEASURES BEAUTY OF FACE

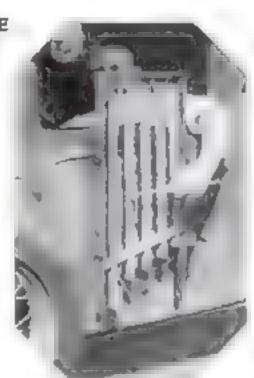




HIS XYLOPHONE SELLS PASTRY

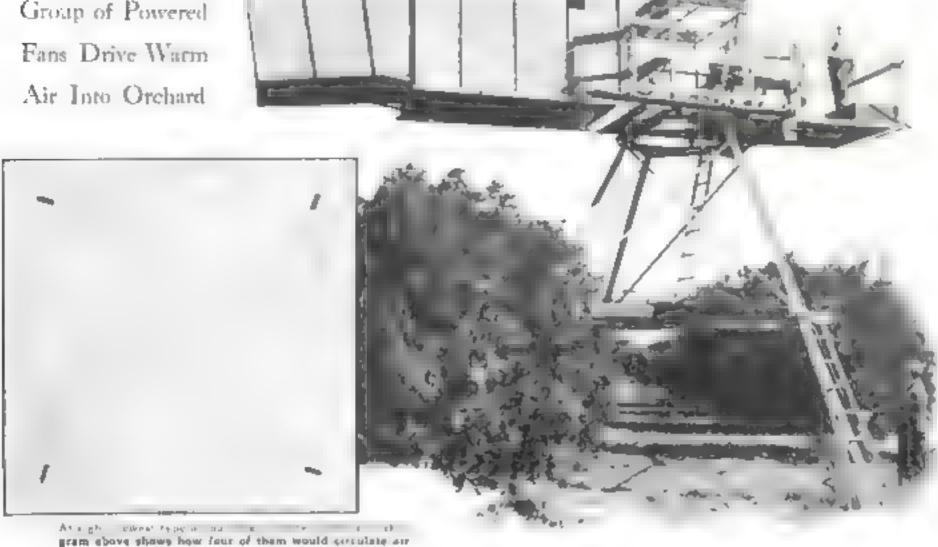


WHEN the housewives in Los Angeles. Calif., bear the notes of a sylophone, they know their traveling baker is at hand. This salesman built, and attached to the door of his car, a five tube sylophone of one-andone-half inch brass pipes. Striking these with a small hammer be beats out a tune. thus announcing his presence and saving hunself the trouble of getting out of his car



Giant Defroster Guards Fruit Trees

Group of Powered



With roaring breezes from airplane propellers save Canforma's citrus groves and Oregon's cranberry hogs from frostbite? Grotesque blowers resembling airplane fuse ages on stills, are being widely installed following successful experiments last year, to combat the costly frosts of late spring and early fail

Whenever frost warnings sound, the big fans wal draw air from the comparatively

warm layer that exists twenty-five feet above the ground and shoot it downward to mix with the colder are below. Four such devices are said to protect a tenacre orchard when set at the corners as shown in the diagram. If a larger area is to be guarded, the four-cylinder motor that turns the propeller also revolves the whole machine on its tower, much like an oscillating fan

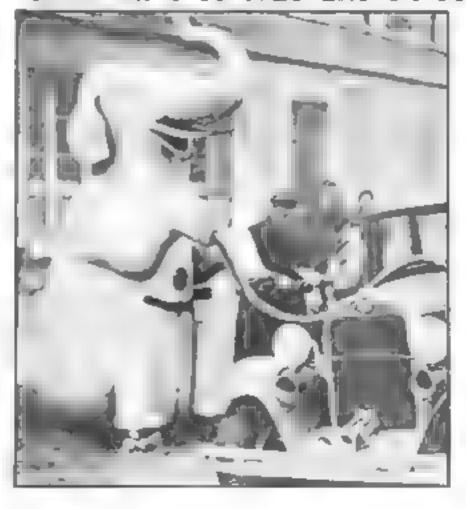
Clouds in the night sky reduce frost danger by retarding the earth's loss of heat by radiation. Bell-jam and paper blankets piaced over small plants have a similar effect. But outside heat, such as bre pors scattered through an orchard has bitherto seemed most effective. Growces hope the new wind machines will perferny as well on a gigantic scale and in the cral prove more economical.

ELEPHANT SERVES GAS TO MOTORISTS



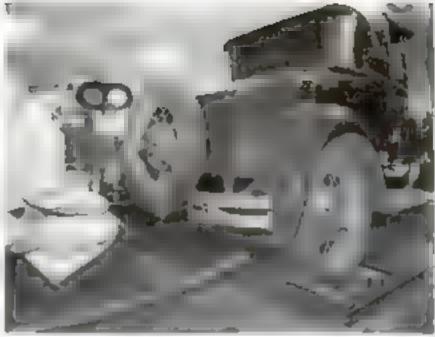
FRENCH BICYCLE HAS SMALL FRONT WHEEL

RETURNING to the design of an oldfashioned bicycle, a French inventor is producing one with a small wheel in front and a large one behind. The small wheel steers, while the large one drives. Handebars are at the rear of the cyclist. The inventor claims his machine embodies scientific principles of balance and structural design. Its rider sits in a comfortable erect position, instead of crouching, so obstructions are unlikely to throw him.



A MOTORIST who passes through the little town of Chateauroux in central France, may stop and fil his gasoline tank at one of the strangest filling Mations in the world. The owner, with an eye to attracting trade, has fashioned a housing for his filing pump in the shape of a monstrous elephant with upraised paw. The customer receives be deared number of biers (a French measure slightly larger than a quart) from a hose drawn out of the elephant's leg, Since the site marks the mtersection of several highways, the elephant station has attracted at ention and is always busy





Car Is Run on Rollers in Garage to Locate Motor Noises

No LONGER need a car owner, seeking diagnosis of an elusive knock, prevail upon n busy garage mechanic to drive with himaround the block, A testing device perfeeted by a Seattle, Wash., inventor, and Iready installed in a number of garagepermits a car to "run" at road speed in a garage. Its year wheels spin upon rolsers, shown above at upper right, which may be braked to simulate a hill. Mean

while the mechanic checks up on the motor's behavior, as shown at upper left, with the aid of gages that indicate the cars speed in miles per hour and the motor speed in revolutions per minute.

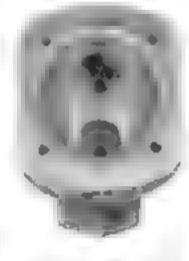
USE LIQUID AIR TO ASSEMBLE MOTOR



SPARK PLUG TOOL HAS FOUR USES

A FOURTNESSE Spork plug tool has just been nevised by a Champa invasivar It comprises a toothed plut for turning the knurled nut and a pivnied prong for testing ignation or scraping off carbon. The copeof he main place 4 a

spacer for he points



I ici in a r has been intersery milit service by of one of one makers to assembling an engine is its herressey to insert a pair of valve sea 4 two nih rings of morning linescin each cylinder hand To get a tight fir holes of the rings are now bored exactly eightme thousand the of an neh undersize in the cylinder heart It 15 tien exprended in a ank of bosons water

Meanwhile the valve seats are shrunk by chilling in a wooden box filled with lugged air Chilling and beating chimnate the size discrepancy and little pressure is needed bighly satisfactory service

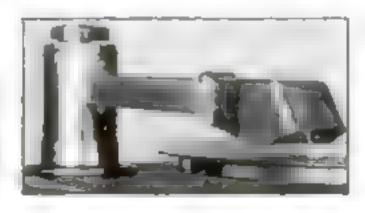


to force the parts together. At normal temperature, they are as tight as if fused together with the result that they give a

STEM OF FOLDING PIPE IS HINGED TO BOWL



Easy to clean is a folding pipe, recently placed on the market. The stem, binged to the bowl section, may readily be anfastened. The proc is carried in a compactly folded position, and is said to be less liable to breakage than one of conventional design.



RECORDS CLEANED BY PHONOGRAPH NEEDLE

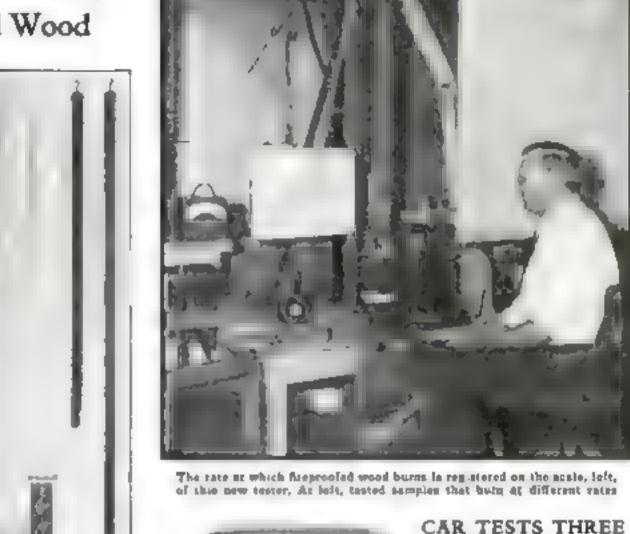
Dust and det are removed from the sound tracks of phonograph records with the cleaning needle shown at the left. The felt pad, which can we seen at the end of the needle but only cleans but is said to reduce scratching and prolong the life of a record by removing all grit

New Tester Shows Burning Rate of Fireproofed Wood

A NEW type of tester to determine the effectiveness of various types of chemicals for fireproofing wood has been designed at the U. S. Forest Products laboratories at Madison. Wase. The tester consists essentially of a tube in which the specimen to be tested is placed, a Bunsen burner with a controllable flame, and a scale registering the specimen's change in weight. By this means the chemist can now determine the rate at which fireproofed wood wilt burn. In the laboratory tests, diammonium phosphate has proved best for fireproofing purposes. In the accompanying picture the results of tests of wood, impregnated to various degrees with this chemical, are shown. Work is now in progress to find substitutes for the phosphate that will be equally effective and more economical. Several testers, made at the University of Wisconsin, have been sent to various other governmental agencies.

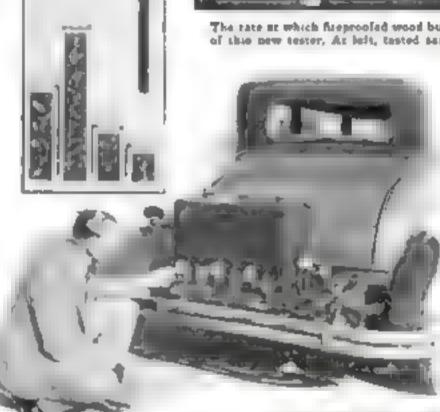
LIFE-SAVER ON BUS SCOOPS UP VICTIM

AN AUTUMATIC life-saving device is built into a sarry-threepassenger has just placed in servnce in England. The apparatus makes it virtually impossible to run over a pedestrian, Contact with a body actuates triggers beneath the front of the bus, automatica ly dropping a binged frame that scoops up the victim from in front of the wheels. Thus he suffers only a shaking up instead of possibly fatal injury if the driver is unable to apply the brakes quickly enough. The photograph below was made during a recent demonstration of the device.



CAR TESTS THREE GRADES OF GAS Witzn G. L. Young, western petroleum engineer, stops at a service station, he buys gasoune from three pumps at a time. His car is equipped with a triple set of fuel tanks and carbureters.

petroleum engineer, stops at a service station, he buys gasosine from three pumps at a time. His car is equipped with a triple set of fuel tanks and carburetora to allow him to compare the performance of vanous types and makes. Any desired fuel is made available in a moment by a conteol operated by the driver, Results of his tests are useful to him in his capacity as chief engineer of a large oil company. Young says that the lowest grades now sold are not bad gasoline, but higher-priced grades are hetter for quick starting



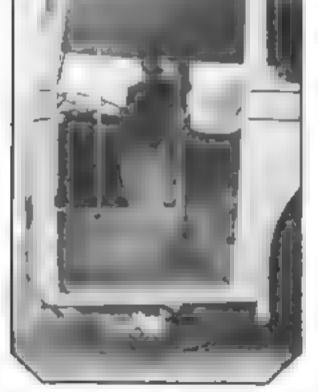
Three gaso ine tanks on this car equipmed with control devices, enable engineer to test gas of varying grades

PHOTO PLATES "READ" BURNED PAPERS

WHEN valuable documents were charted beyand recognition in a recent Wisconsin fire, it was thought their contents were forever lost A police scientist took them, however and made them reveal their meaning. The charred remains were firmly compressed between two photographic plates and left in total darkness for three weeks When immersed in developer, the plates showed images of the documents The process depends upon the different rates of chemical reaction between ink and paper.



Upper half of this pictore shows the condition of the charged documents and lower half shows what photo plates revealed on them

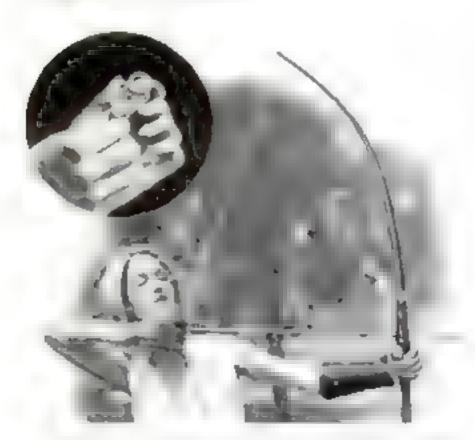


Automotic scoop on front of this bus drops to catch victim, as photo phoses, and paves his bile



MYSTERIOUS COSMIC RAYS TRAPPED FOR STUDY IN SCIENTIST'S BASEMENT

Study of cosmic rays, mysterious radiations from space, more penetrating than X-rays, has been brought out of the laboratory and placed on a more homely basis by recent tests. Putting in his own basement the bomb-like detector shown in the photograph above, Dr. Robert A. Milikan, California physicist (right) found the rays streamed through the roof and walls of his house without appreciable hindrance, Meanwhite University of Chicago experimenters accelentally discovered that the burnan head absorbs five percent of the cosmic rays that strike it while the rest pass through

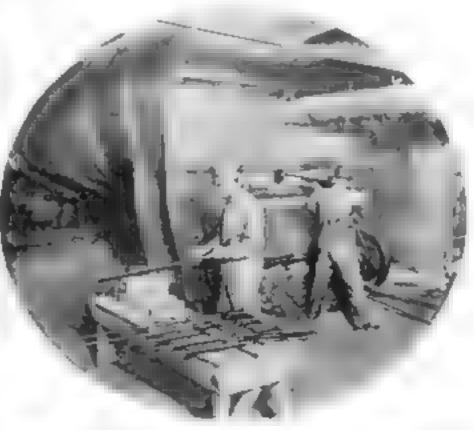


SIGHT ON BOW HELPS ARCHER'S AIM

An archery sight, said to improve the accuracy of howand-arrow shots fifty percent, was recently demonstrated at Los Angeles, Calif In aiming at a distant target, an archer must point his arrow well above it. Consequently, at the moment of releasing the how string, he does not see the target In the past he has had to depend largely upon his "feel" of the distance to score a hit. The archery sight contains two prisms which deflect the light enabling the archer to see the hullseye and to aim his arrow so it leaves the how at the right elevation. The right may be adjusted for distance.

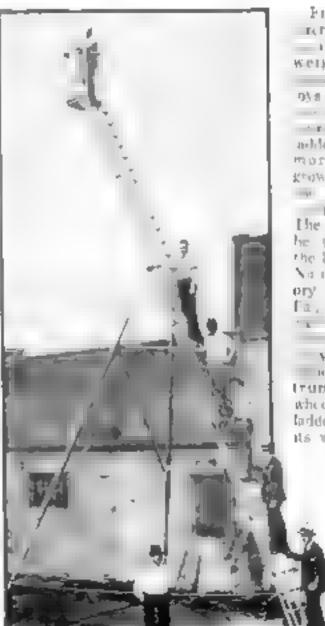
GUNS CLEAN CEMENT KILNS

Bearing away with repeating shotguns, workers in a middle-western cement factory now clean out kilnt in which hardened cement has formed. In the past, to clean out the cement the kiln had to roof off and then men with sledgehammers would enter and break away the cement. By using long-barreled shotguns and No. 12 shot, the rings are now knocked loose at a great saving in time and money.



Shougans are used to loosen coment that has hardened moids the kiling former a men with studge harmours knocked these rings of coment loose

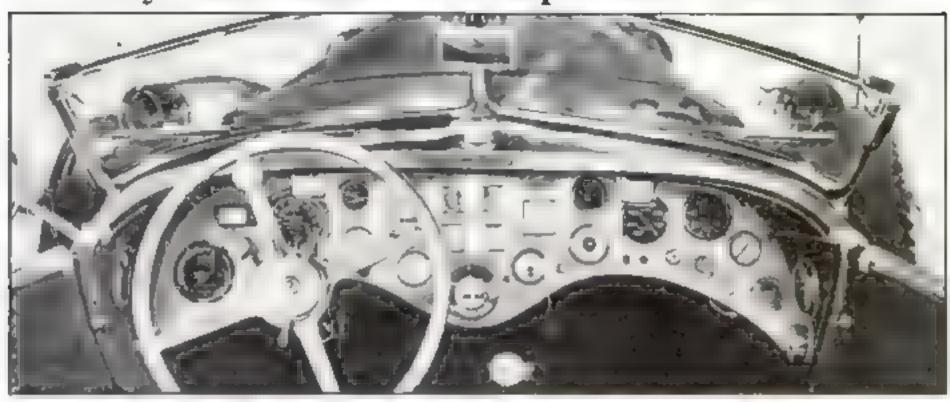
ONE MAN HANDLES THIS BIG LADDER



FIRST employed in refall construction - save of their light weight and great uminum aloys are do ly finding A fortyexicustry adder that we ghe no more than a fullgrown man is one of to at recently p of hese alloys. The but ladder is to he taked in cleaning the light fixtures of a No tonal Guard armory at Pittsburgh fig. which are too reached by ry means. It y clawere , me and easily trundled about an whees, A wooden laddet would be twice its weight.

This extension
ander made of
currendmentoys
a forry four
feet long but
was the only
72 pounds and
ne man the currend
ay push it around

Fifty Instruments Help Run This Car



Forty one instruments inside this car include ordinary eagos and also it is

Controlled instruments to place on his automobile in the unusual hooby of Law cence Grayron, of Los Angeles Cafil horty-one, to date, grace his car's driving compartment, with nine more outside liesides regula ion motor instruments they because such povelities as a barometer for foretelling the weather, on aftimeter

to show Gravson his elevation, an airspeed indicator, a periscope a compass, and a device that shocks a would-be car thief by focusing an electric charge of 2 500 x dix



IMITATION BRICKS FOR OLD HOUSES

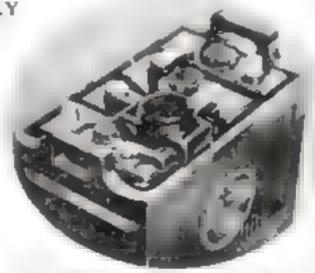


This bricks of Portland coment and asbeston fiber laid over wood soding of a boule, transferre it into a modern dwelling

Out frame houses are given a handsome new exerior by means if an peraction brack recently perioduced. The brack conseing of thin slabs made of Portland cement and ashestos fiber, are laid directly over the wood The result is a modernize l dwelling difficult to ditogrash from one of real brick Not only does the conting improve the apnearance of a home, accorning to the maker but it also serves as an insua reg blanket that will keep the house warmer in war of and cooler in he hot summer cave

DUAL VOLTAGE BATTERY STARTS COLD ENGINE

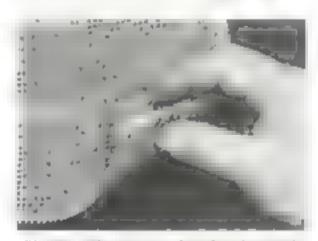
To overcose hard starting during the cold wanter months, a novel dual voltage automobile battery has just been placed on the market Its four cells normally deliver the usual six volts. When a cold motor must be started, however, a push but on on the dashboard actuates an electromagnetic switch on the battery (indicated by arrow) and alters the connections on the last two cells from parallel to series, boosting the power of the bottery to eight volts. This turns over the starting motor rapidly and insures a hot spark for ignition



Dual voltage battery with switch, indicated by the arrow, can be stepped up to start an auto

REINFORCED CELLOPHANE NOW USED AS WINDOWS

Usive cellophane as a substitute for glass is the latest application of this versatile material. To serve as temporary windows in buildings during construction or remodeling, a flexible and waterproof tellophane sheet backed on one sire. Ly a mesh fabric has been introduced. While admitting light, it keeps the heat to anothe rain out. Dust can be washed off



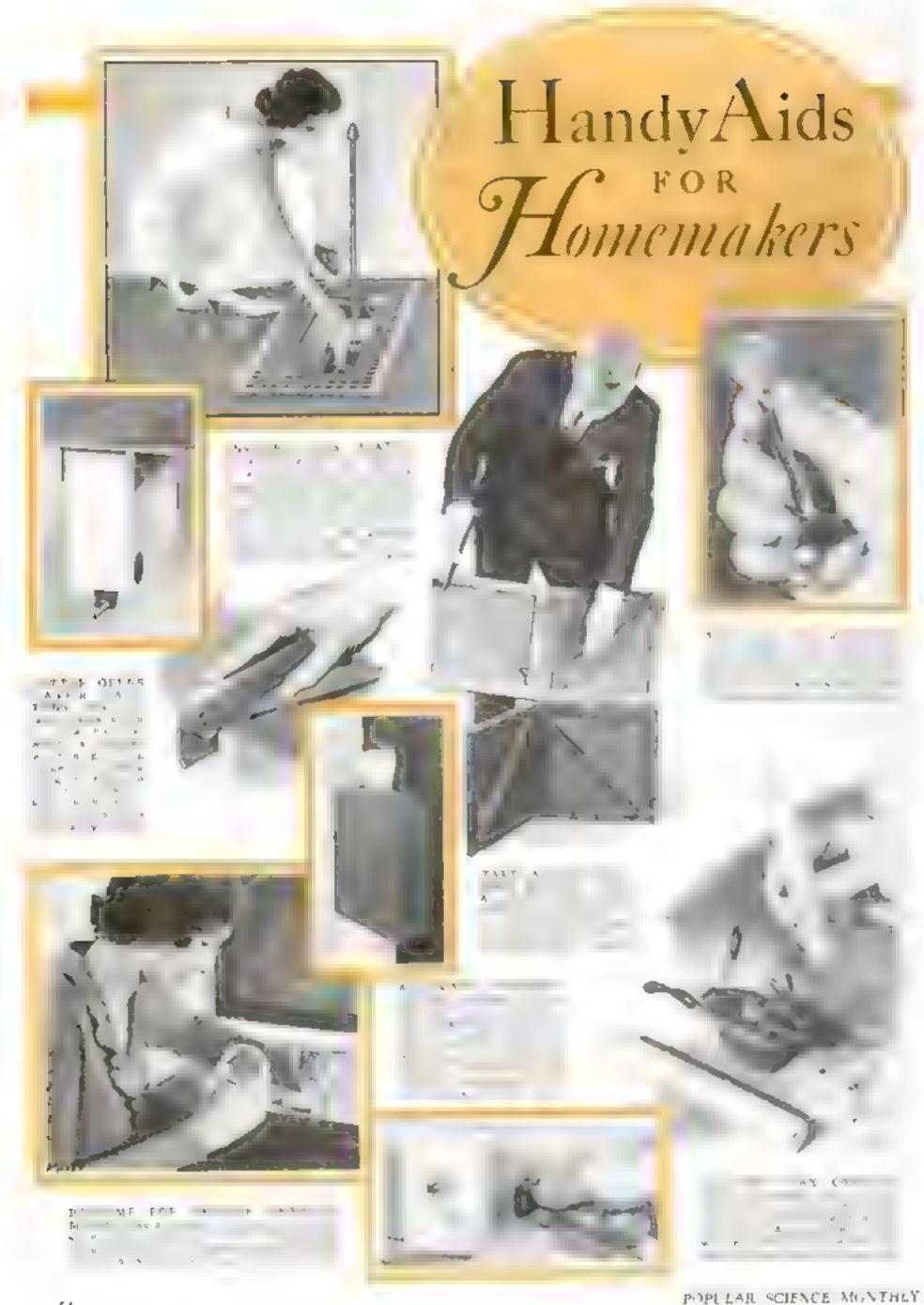
Plexible cellophane, reinforced with a mesh fabric, is now used as temporary windows

PERFORATED CLUB HEAD LENGTHENS GOLF SHOT

Luxuer shots are made possible with a new perforated golf clob, according to the inventor. Holes drilled in the head enable air to pass through without hin-



drance, so that air resistance will not retard the swing. Thus the full power of the player's stroke is expended upon the ball







PHO	T, CTS	E) 5	- E .	7.41	-	Т	ч
4	P 2 5 6		4	6	11		
	a		de		li		
			4		- 6	11	

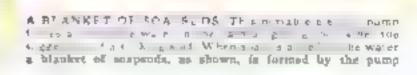
CLCK WITHOUT HAN IS N to have be a con-



e rulingage he n fall as frat makes as a s







COLAM ER

IATO ST V

T A n he

T w maw

R w m s w

Or n. of w

Or n. of w

No Tenoving be

C P C T ny

ho 3 he 3 6 y

so it sant fell co

Chemicals You Can Make



EXPERIMENTING with acids and alkabes the amateur chemist can make many of the chemicals be uses in his home lithoratory. In this way, simple reactions, that require little equipment, become profitable, interesting, and instructive.

When an acid and a base combine in the right proportions, a new substance is formed. Sal ammoniac, for instance, can be made by holding an unstoppered botde of ammonium hydroxide (bousehold ammonia will do) next to the open mouth of a hydrochloric (munatic) acid bottle. The sal ammoniac appears as a dense white cloud that will float in the sir and

eventually disappear

This novel reaction forms the basis of an interesting experiment that can be auded to the amateur magician's bag of tricks. Wet the stopper of the muriatic acid bottle, by shaking the bottle, and touch the moist stopper to the palm of the right hand. This will place a harmless amount of acid on the skin. Do blewise with the moist stopper of the bousehold ammonia buttle, placing a small amount in the paim of the left hand

To the casual observer, both hands will appear empty. However, when they are cupped together and the two thumbs placed to form an exit hole, dense clouds of white fumes will pour out. To prove your bands are empty you can move them apart only to place them together again and produce more of the mystifying sal

ammontae amoke,

Similarly, two apparently empty glasses -one containing a drop of ammonia water and the other a drop of muriatic acidwill smoke when they are placed together

In combining, the acid and the base in each case neutralize each other to form a new substance—sal ammoniae (ammonium chloride). Chemists call this reaction neutralization and make use of it as a test for computing the relative strengths of chem-Hala as well as a means of producing other chemicals.

Neutralization can be demonstrated in the home laboratory with the aid of an indicator such as an alcohol solution of phenolphthalem obtainable at any drug

First make up a limewater solution by

dissolving time in water Shake it vagorously for several minutes and allow it to settle Then catefully pour of the clear upper liquid

Next place one drop of munatic acid in a beaker and to this add some water and a dropof the phenolphthalem solution. Then with a medicine dropper, slowly add the limewater to the acid solution in the beak-



Valve grinding compound in put on the glass stopper and t in then twisted back and forth inside the neck of the bottle to wear it to proper size It must also be pushed in and out to keep it perfectly round

Acids and Alkalies Easily Combine to Form Nesn Substances You Can Use in Experiments

ByRAYMOND B. WAILES

er, counting each drup as it fails and sirring the acid continually. Add the limewater in this way until a single drap colors. the bould red. When the red color remains for al least a quarter of a minute it incates that enough ismewater has been anded to neutranze the acid

You will probably find that about 240 drops of the imewater will be needed to neutralize the single drop of munatic acid. By repeating the test with other bases, their strengths can be compared

In a similar monner, a weak lye solution made by dissolving several pea-size pieces of lye in a half pint of water can he used for comparing the relative strengths of Vinegars (acetic acid). The stronger the vinegar, the greater will be the amount of Ive water needed to neutralize it. Of course, it is important that the same quantity of vinegar be used in

Common Substances That Can Be Used in the Home Laboratory

COMPLEX NORE

Alum

Bleaching powder Boracie acid

100 Calomel Chalk

Соррегав Cream of tartar Epsoen salt

Glauber's salt Limewater

Lyo Quicklime Rochelle salt

Sal ammoniac Sal soda

Water glass

Sec. Washing soda CHEMICAL SAME

Potassium aluminum sulphase

Calcium bypochiorite

Borie acid Sodium terraborace

Mercurous chloride Calcium carbonate Ferrous (iron) suiphate

Potassium bitartrate Magnesium sulphate

Sodium sulphate Calcium hydroxide solu-

Sodium hydroxide Calcium exide

Sodium potassium tartrate

Ammonium chloride Sodium carbonate Sodium chloride

Sodium carbonate

Sodium plicate solution

in Your Home Laboratory.



fests of this sort are reterred to be the admissibility than ist as titrations and a special measuring tube used to drop the one liquid into the other is called a burrette, Commercial buretter are expensive but the home experimenter can make a good substitute from several feet of half neh diameter glass tubing, a medicine dropper, some rubber tube, and a spring ciothespin as shown in the photograph on this page.

THE long glass tube is fitted with a stopper through which projects the end of a small glass tube. The glass portion of a medicine dropper is connected to this projecting tube by means of the short length of phable rubber tubing. The spring clothespin, placed over the rubber tubing as indicated, serves as a valve for controlling the flow of liquid from the tube.

On commercial hurettes, divisions etched on the long glass tube tell how much of the liquid is used in each iteration. With the humanade burette, the amateur chemist can obtain a similar result by keeping an accurate count of the drops falling from the tip. If desired, an alive bottle with its bottom removed can be substituted for the large diameter glass tubing

By neutralizing sodium hydroxide (lye water) with dilute sulphuric arid, the home chemist can make sodium sulphate. Place the axid in a beaker or other convenient glass container and add a drop or two of the phenosphthalem solution. Fill your homemade burette with the weak lye solution and adjust the clothespin so that

had (base) turns the solution red, neutralization is complete and the heaker will contain sodium sulphate in solution. The solid sodium sulphate can be obtained by heating the solution until all the water has been deven off. This can be done by boiling the solution until only a few ounces are left and placing the remainder on a water or steam bath as described last month. When all the water has been evaporated, white sodium indiphate remains and this can be bottled and abeled.

Neutralisation produces heat. If the solution becomes too hot during the above process, add a little water to the beaker.

Acids and bases also can be made to seact with salts to form other chemicals for use in the amateur's laboratory. Epsom salts, chemically known as magnesium sulphate, can be used in making several magnesium compounds.

MAKE a solution of Epsom salts in water, place it in a beaker, and to it add lye water. A white precipitate will be formed. Allow the beaker to stand for some time and you will notice that the white precipitate settles to the bottom.

When it has completely settled, and one or two more drops of the lye water. If more precipitate is formed, add more lye water and again wait for the precipitate to settle. Test the clear liquid with a few drops of lye water as before and repeat the process until no precipitate is formed.

The white substance resting on the bottom of the beaker will be magnesium by droude. Pour off the liquid, and clear water, shake it, and again pour off the liquid. Repeat this several times to wash the magnessian hydrox is thorough; After severa such washings, test for the presence of lye water in the clear wash liquid by using litmus paper or phenolphtha sh sociation. Red nimes will turn but and the colorless thenophthalesh solution will turn red if the slightest trace of we water remains. If necessary, further washings will remove every trace of the caust c

PLACE the precipitate in an evaporating dish and remove the water that remains by placing it on a water bath. Then heat the dish until the precipitate is dry. The heat changes the original magnesian hydroxide into magnesium oxide or magnesia. If this is dissolved in muriatic (hydrocholoric) acid, magnesium chloride will be formed. The solid magnesium chloride can be obtained for bottling through the use of a water bath

When dissolving the magnesium oxide in the acid, use more of the oxide than the acid. In this way, not all of the oxide will be attacked. Filter and then evaporate the water, This will prevent the final product from being contaminated with the acid.

If the magnesium oxide is dissolved in ritric acid, magnesium mitrate will be formed. If it is dissolved in sulphuric acid, magnesium (Continued on page 99)

Stunts

TO DEMONSTRATE

Natural Laws

Scientific Facts Tested with Simple Apparatus

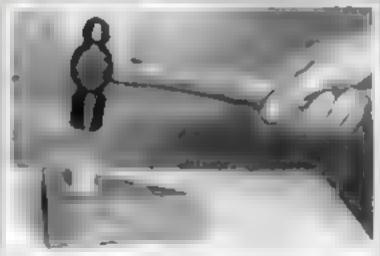




HOW STRONG IS YOUR LIGHT BULB? The randle power of any agin can be determ ned with approximate accuracy in the manner if untraced above. An upright rod a placed in front of a above of white paper. A candle and a light bulb are arranged to throw shadows at different angles. Move the light bulb back until the shadows are of the same intensity Since the intensity of the light verses inversely so the aquere of the distance of the accuse from the source, a simple calculation gives the candle power of the bulb

WATCHING METAL EXPAND. Cut a small spiral from a sheer of tin Hold this spiral as shown at right over a cand's flame. The expansions due to beat will be easily seen as the tin firetable when but and contracts as a cools of

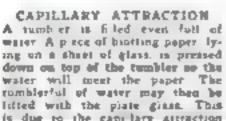
COLORS MIXED WITH GLASS When yo low and blue pages are mixed, they produce green. However an entirely different result in gained with I ght rays reflected from yellow and blue paper as distincted above. When two pieces of paper are principled with a bheet of glass are between them, the observer aching at the nearer paper will see a duly shade of grey This is due to fusion of the light rays rather than in a blend of pigment we is the case in the use of paint.



A NEEDLE THROUGH A COPPER DISK Press a needle assight through the center of a curk Place the disk on a block of wood and on top of the disk put the cork and needle the head of the needle being flush with the top of the cark. If the needle is hit sharply, manight down, it will pietee the copper



MAGNETIC GLASSES to one of the glasses place in i ghird candle. Smear the edges of both grasses with lard. Invertione gians over the other as shown foon the candle goes out, and the glasses which together held by the vacuum that was created by the expen-consuming candle fame.





PIREPROOF PAPER
Place a small pleus of the
forlown about of paper and
hold the paper over a flame.
It will surprise you to see
that the pater will not burn
up: the ofoll has melted.
This is due to the rapid by
with which to for a conducta
heat thus keeping the
temperature of the paper
to low that it cannot burn

MAXING SUGAR BURN As you know sugar me to without burning with a flame. Place a pinch of eigereste asbes up a pioce of sugar and bold it a a firms. Due to the estallytic action of the ash, the sugar will burst into flame.

Homemade Test Lampfor RADIO

Pocket Flashlight Readily Converted into Handy Tool— Self-Locking Lugs for Portable Sets

ADE from an inexpensive flashlight of he metal fountain pen type, the combination test lamp and produstrated at the right is a compact tool for the handy man's radio ki

Aside from the flash ight, which can be purchased in most five-and-ten-cent stores all that is required is a machine screw and nut, three fiber washers, some insulated wire, and a small battery clip

The machine screw is in serted through a hole drailed in the closed end of the metal flashinght case. The head of the screw forms the contact for the sinc body of the lower flashinght cell and the outer

end, when filed or ground to a tapering point, forms a convenient test prod.

Three fiver washers are used to instrate the prod from the case, large washers being placed inside and outside and a smaller one being fatted between as indicated in the sectional drawing. A nut holds the washers and machine screw in place

The prod forms one terminal of the test lamp circuit. The other terminal is a small spring clip saidered to a length of insulated wire which in turn is soldered to the metal case of the flashlight. When used in testing small coils, fuses, and similar parts, the tiny lamp will light if the circuit in unbroken. It can also be used to test concensers for short circuits. Such a tester, it should be understood, can not be used where any great amount of resistance is involved.



An automatic pencil having a metal case can be fastened to the clip terminal and used as a second prod if desired. By supplying the prod with a cloth or leath or cover to insulate it from the clip, the combination test lamp can be carried in the vest pocket like a regular fountain pen—to once Johnson

EASY WAY TO FIGURE VOLTAGE ADJUSTMENT

RADIO experimenters who design their own battery-operated receivers can calculate easily the size of the variable resistor to be connected in series with the tilaments or heaters of the tubes and the power source. By a simple application of Ohm's law, the required resistance in ohms is equal to the difference between

the supply voltage and the rated voltage of the type tube being used, divided by the total rated filament current for the ubes.

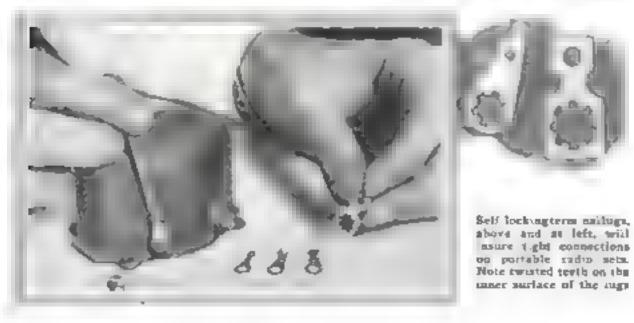
For a series connection of type '36, '37
'15 or '39 tubes in receivers operating from a direct current bouse line, the required resustance to be placed in series with the heaters can be found in a similar manner. Subtracting the sum of the tube voltages from the line voltage and dividing by the heater current in amperes for a single tube gives the value of the resustance in ohms

The various rating values are given on a slip of paper packed in the box with the tube.

SELF-LOCKING LUGS CAN'T VIBRATE LOOSE

WHEN building an automobile receiver or any type of portable radio, the danger of having binding post connections shake loose can be eliminated by using the self-locking type of soldering lag shown in the illustration.

Having a series of curved spring like teeth surrounding the portion of the connector that fits over the terminal, this ingenious lug grasps the surfaces of the binding post nut and base to hold it firmly in place and prevent the nut from vibrating loose. These combination lugs and lock washers can be obtained in a large variety of different shapes and sizes to meet every radio need. Separate lock washers of the same type are also available to the home experimenter





FOR USE OF AMATEURS

By John Carr

icrophone circuit described st month. The microphone, sittery, and the microphone ransformer are connected o the B-supply to the tte of the oscillator but o obtain better modulation audio ampliñer is placed the circuit to magnify the voltage variations set up by

the microphone cir

har beer results the a ten, aromiser should con on a gain con rol placed after the first stage. The power of the output tube or modulator connected to the two stage amulifier should be equal to or greater than the tombased power of the tuber in the oscilthe for the ut for the FORECAR STENCE MONTHLY tansmitter

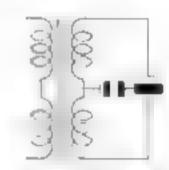
a type '50 tube should prove adequate. The amateur owning a modern broad-

east receiver equipped with a good amplifying system and a phonograph attachment fack, can arrange an experimental modulating circuit similar to the one

shown without any additional expense Wares wound around the plate prongs of the output tubes will serve as leads to the short wave transmitter and the phonograph jack provides a means of connecting the interophone, buttery, and microphone transformer into the circus

When experimenting with a radio tele-

phone, the ama teur should manitor his wave before actempting to put his voice on the Bir This can be done by moving his short wave re ceiver to another part of the bouse where he can listen to his own transmitter oper



Il ok up far doob ebutton microphone

ated without an antenna. In this way he can tell just what quality he is obtaining before going on the air. It must be borne in mind that only three bands are open for amateur radio telephone use (5 to 5.36, 84.5 to 85.7, and 150 to 175 merers)

Many amateurs use the double-button microshone in preference to the simple engle-button variety. This type has three connections instead of two and is used with a special spalt winding transformer,

ITHOUT altering the original circuit in any way, the POPULAR Sct-ENCE MONTHLY short wave transmitter can be transformed into a practical radio telephone for amateur use, In fact, any short wave transmitter can be adapted easily for microphone

Cremer William

Last month I outlined the principles of the mano telephone and described the equipment accessary for an experimental modulating system consisting of a carbon microphone, a battery, and a microphone transformer connected into the transmit ter in such a way as to vary the plate voitage of the use llator accurring to the sound waves striking the metrophone diapit ragera.

For the more efficient circuits shown on his page, the amoteur need only supplement the equipment be used in the experiments last month with a two stage audio amplifier, a modulator tube, and a suitable output transformer or iron core choke depending on the diagram followed.

If desired, the modulator can be constructed as a used using a B supply separate from that of the transmitter. When this is done, the circuit shown in diagram A should be used. By following the connections shown in B, the same B supply can be used

In the power circuit for the transmi ter -B should be connected to -F when using a, a, on the filament or to the exact center tap on the transformer if A. C. is used. As explained in the short wave transmitter article (P S M., Aug. 52 p. 65), -B is grounded.

Basically both of these assiems open ein a manner similar to the elementary

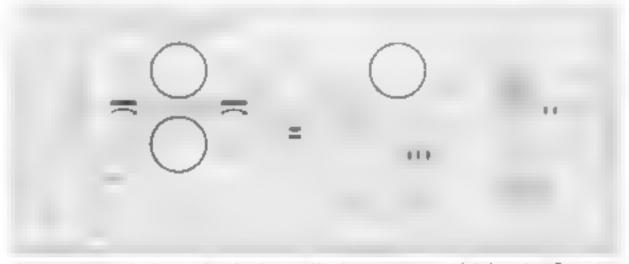
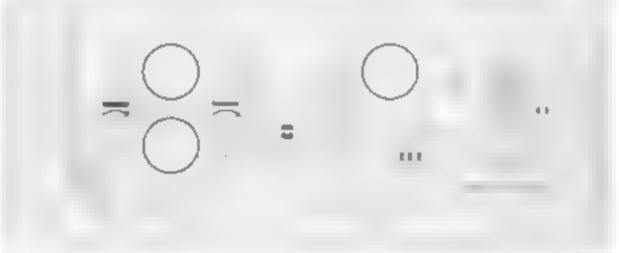


Diagram showing hook up in Fogular Science Monthly transmitter with independent B supply



In this elecult, the same B supply can be used for both the modulator and the oscillator

ореглизов

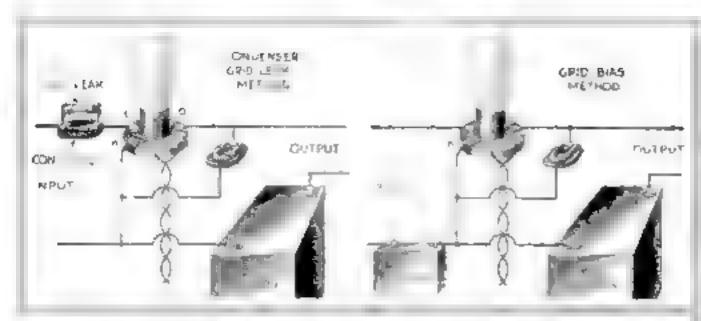


Diagram abowe extruit for grid-bise desector and for a condenser-grid legit dezector

How Detector Tube Helps Radio Set Work

 $B_{\mathcal{F}}$

GEORGE H. WALTZ, JR.

ONSIDERED in one way
the detector take is the
most important unit in
a receiving set Without
t, the various amplifiers added to
help the receiver do a better job
would be worthess

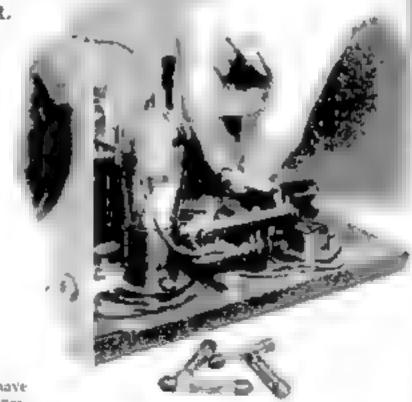
Incoming radio waves picked up by he abtends condet en to our breakess receiver can be considered as consisting of we take wave and the variations in the swing of this wave caused by the electric equivalents of sound waves impressed on it at the transmitter. Graphically, the waves reaching a receiver look like A in the drawing at the upper right

In the complex form, the waves have no effect on our loudspeaker or earphones. To operate these sound making instruments, one-half of the alternating garrier must be discarded and the autho or sound portion of the other half separated from it. This rectifying of the alternating carrier and extracting of the important audio-frequency portion of the wave is the job of the detector tube.

Detection in other words is the separation of the voice or music from the incoming wave so that it can be further implified and finally transformed into sound by earphones or a loudspeaker.

The beginner who wants to know how the detector tube works should first familiarize himself with the simple action of any vacuum tube as described in a recept issue (P. S. M., Dec. '32, p. 55).

In common practice, a tube used as a detector can be wired as a grid-bias detector or as a condenser-and-leak detector. The simple diagrams for both these circuits are shown in the drawing at top of this page.

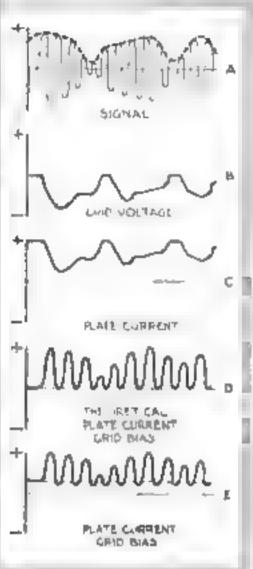


Using a grid leak mounting various carridge grid cake can be tired. The use working best can be used

The combenser grad-leak method, which is the older of the two, is based on the fact that if the grid of a vacuum tube is made positive it will act more or less like the plate and attract the negative particles of electricity, called electrons flowing from the surface of the bested carbode. The extremely sample circuit consists of a fixed condenser connected in the wire leading to the good and a resistance known as a grid leak, connected across the condenser in the manner illustrated in drawing at upper left.

In a receiver, an incuming shead sets up an atternating vultage in the circuit and the grid of the detector becomes alternately positive and negative

When the grid is positive, it acts like the plate of the tube and attracts some Drawing below shows how waves look when they reach receiver and the modifications that take place in the waves through the acress of the detactor of root



of the electrons flowing from the heated cathode. When he grid becomes negative, however, it no longer attracts these electrons and, by the stopping action of the grid condenser, the electrons it did cohect during the positive alternation are trapped. Unlike the cathode, which is heated, the cord

grid can not throw off these trapped electrons so they remain impresoned.

During the next alternation of the signal, the grid again attracts and traps more electrons so that as the cycle is repeated the grid be-

comes more and more negative. As its negative charge increases, it repels the electrons flowing from the cathode with increasing strength and causes an increasingly greater decrease in the flow of electrons to the plate.

If the electrons trapped on the grid were allowed to pile up they would soon choke the tube and prevent it from operating. At this point however, the grid leak resistance comes into play and allows the trapped electrons to leak back into the circuit between each series of waves.

Connected into the plate circuit of the detector tube is the B-battery. As the flow of electrons to the plate is decreased by the action of the gnd, the current flowing in the plate circuit therefore is also reduced. In *Contrased on page 1011

GUS WILSON tells what to do

When Brakes Won't Hold

Greasy Linings and Poor Adjustment Add to Danger of Quick Stops on Road



An the door of the car awarg open, Gus recognised Neck Rank is a busile or the Model Go age

INE snow swirled along the frozen ground as Gas Wason battered beside a telephone pole, waited impatiently for a crosstown but.

"Taxi, m ster?" called a voice as a snow-covered sedan came to a ferking

stop in front of him

A while curtain of snow hid the drivers face but as the door of the car awang invitingly open Gus recognized Ned Rank a one of the best customers and boosters the Model Garage ever had.

What s the matter Gus, afraid to drive in the snow?" Gus Rankin grinned

"No, just giving the car a little overhauling" replied the veteran mechanic "and I've had so much other work. I

uidn't have time to finish it

Well, I'm in luck, running into you like this," said Rankin as Gus combed in beside him. "I was going to stop in and see you some time today. My brakes are on the bunk. You heard them squeal when I stopped just now. I've got to stand on the foot pedal to stop the car. I want you to put on some of that dressing that makes trakes bold.

"We don't keep that sort of stuff, it's only a makeshift anyhow," replied Gus. "Why not stop in at the garage and let me look at your brakes. Are the linings

very ald?"
"No they we been in only about four

months." said Rankin, "They can't be worn out already" "Weak brakes can come from lots of ings beside ordinary west," Gus in formed him. "The finings get glased over or dirt gets imberkled in the fabric, or washe the limings get coated with grease or oil

The funny thing is." went on Rankin they hold fine when I first start out in the morning. But by the time I've driven a few miles they begin to stip

Sounds like grease on the limings,"

WHEN they reached the Model Garage, Gus drove the car to the reas where his report bench was located. Joe Clark, Gus a parener, and Rankin stood case by at Gus donned his overalls and went to work

"If brakes bold when they re cold and ship when they heat up, it's generally a sign grease is causing some of the trouble Gus murmared as he removed one of the By MARTIN BUNN

wheels and began scrubbing the greasecoated fining with a stiff brush seaked with gasoline. "Grease from your rear end has been leaking out I'll have to put new grease retaining washers on when I get through or you'll be having the same trouble all over again

Lucky for you, these hinings aren't an had. Sometimes so much grease gets on the brakes that a gasoline both doesn't belp. The only thing to do then is re-

line."

Does water have much effect on brake

hungs" Rankin asked

"I'll say it does," Gus reputed, "and it acts in two ways. If the langue just get most, because the car has been left in a damp atmosphere, they'll grab and let out awful squeals. If they get wet a rough, they won't hold at all

"WATER S an easy thing to get rid of, though," Gus pointed out the you've got to do is run the car for abort distance with the brakes parily the heat of friction wall turn the water to o steam and leave the horizes perfectly

Remember that on tooring car I had some years ago?" Rankin recalled, byery one I d put on the brakes, they'd chatter like couple of pet parrots, What

caused that?

Generally chatter is caused by loose parts," said Gus as he put a wheel back into place, "but a broken anchor bracket or loose liming rivets will cause it too, Sometimes the brake linings get stocky and chatter, but a gasoline bath will generally remedy that

"The hardest charter to locate comes from pour adjustment. If the end of the brake band or shoe is forced into the drum, the liming hands at that point and generally sets up a how!. To be right, the pressure on the lining should be tan gential to the drum," Gus explained.

Rankin grunted as he picked up a scrap of brake lining (Continued on page 100)

GUS Says: When installing spark plugs, use gaskets and be sure that each plug is screwed tightly in place. If the plugs are set at an angle or placed in the side of the motor, install them so the grounded electrodes are on the bottom side. This is particularly important on motors that pump oil. If the grounded point is placed so that it is on the top side, the excess oil will drop on the plug, drip on the insulated point, and foul it.





MODEL MAKING : HOME WORKSHOP CHEMISTRY : THE SHIPSHAPE HOME

A Pocketknife Model



FEBRUARY, 1933

43

razor blade will come to bandy for this work.

It is best to cut cardhoard patterns for marking
the top pian lines. The deck
levels will not interfere
much when doing this. Saw
and plane or carve the exceis wood away to the lines
and tound the bottom edges
to a radius of about 3 to
in. Your boat will look
crude at this stage, but have
pattence a lit le more shaping, and you will be surprised at the result

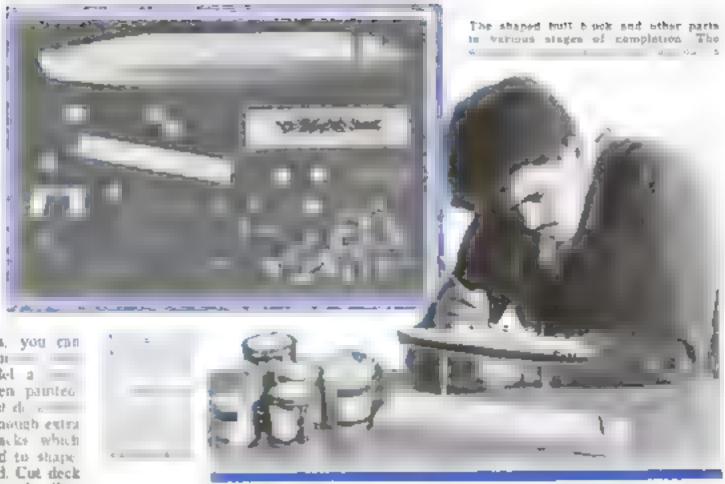
Taper the bow end and stem carefully, allowing space enough for the propellers to turn freely Finish with medium and then fine sandpaper. By using your

eyes as well as your hands, you can easily make a hull of true conthis will help give the model a craftsmanlike appearance when painted

Your next step is to cut out do a B from 3/16-in, pine. Allow enough extra length to get out the smokestacks which should be whit, led and sanded to shape then cut to length and beveled. Cut deck unit C from 1/8-in, pine and allow enough over to make P, G, and J

The lifeboats can be cut from 1/8 in square pine, which can be sliced off the 1/8-in, stock and planed to size. A rule and rasor blade will do this job in short order. The bridge E and parts K, L, and M are also made of 1 8 in, square stock

The boats, being so small, may be hard to hold, but they can be shaped easily enough if the work is done slowly and carefully Cut them all to length with the rasor blade and whittle them to shape finishing with a small piece of sandpaper

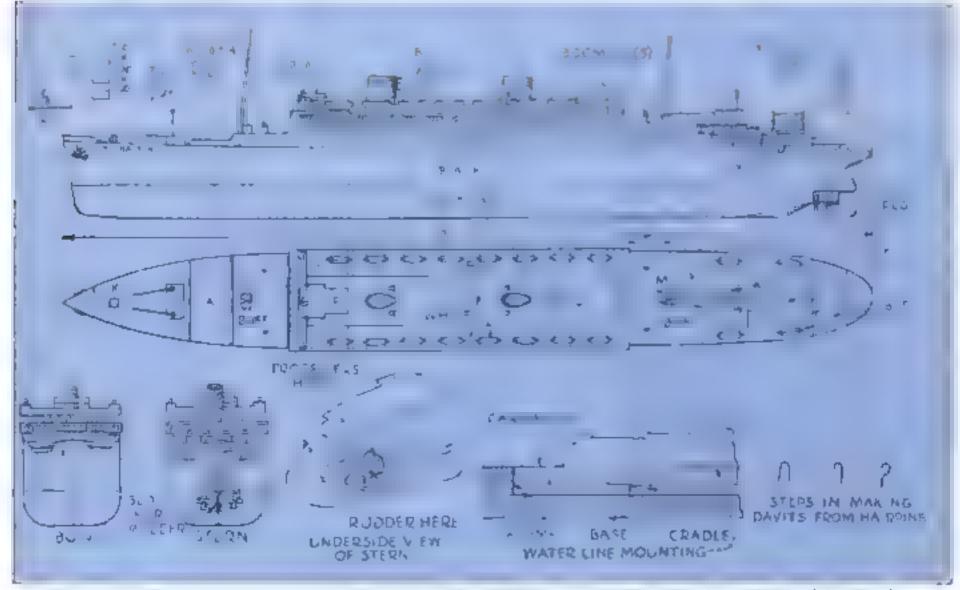


To prevent splitting, he troy boles for the dayns should be drilled first

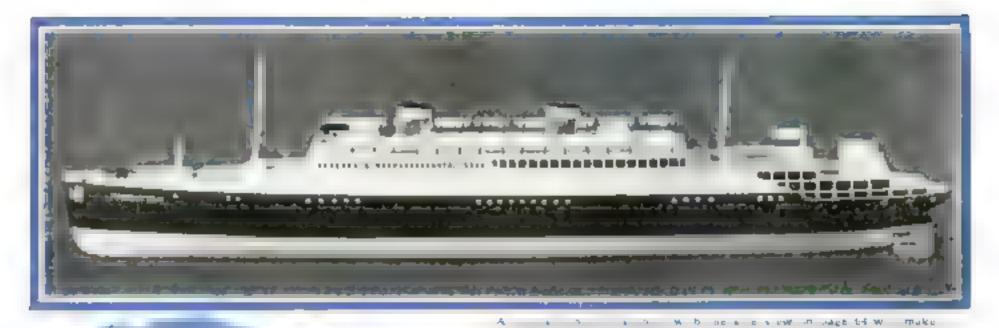
Deck unit D should be made of cardboard about 1/16 in thick, and also cut unit H of this material. The clay-coated kind will take point well. Use the rasor blade to cut the cardboard to size. These parts should be glued in place with casein glue or any good household cement. All units should be fastened on in the order in which they are lettered. A, B, C, D, E, and so on. This will save time.

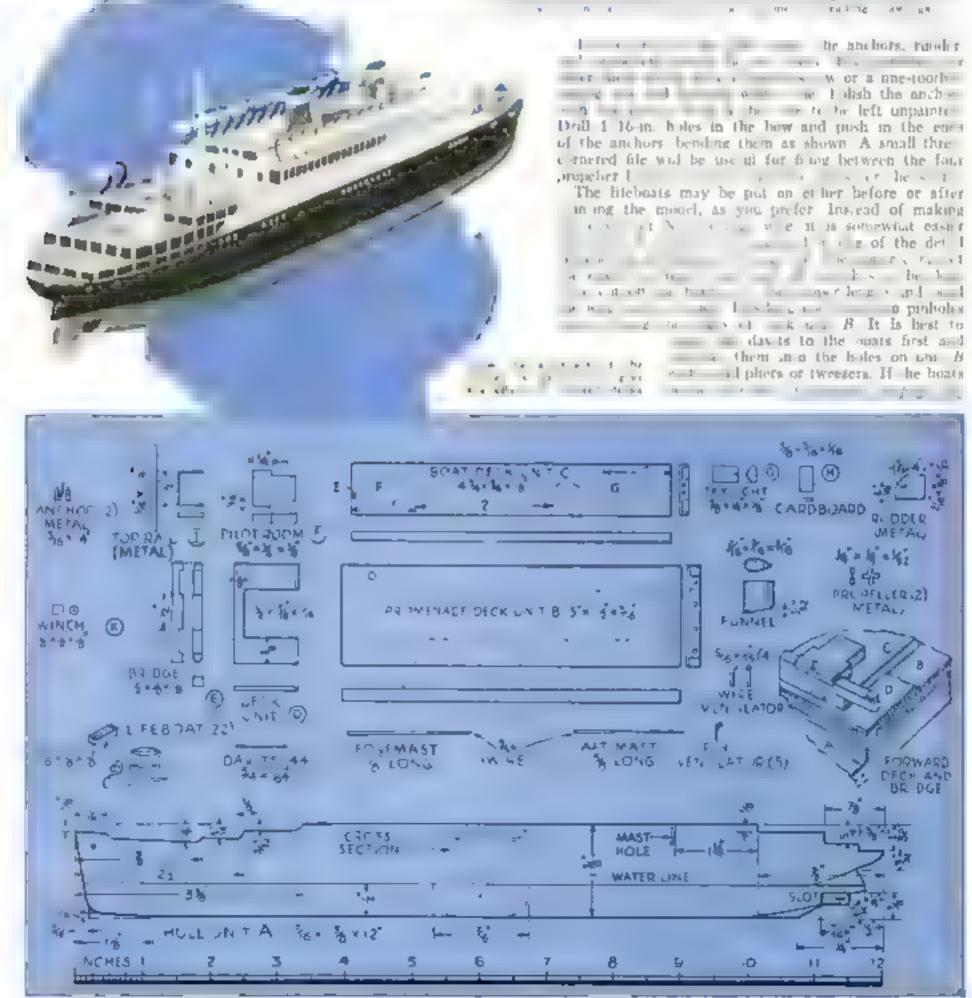
Make the four top deck ventilators of

I 16 in diameter soft wire Bend at right angles and then saw off the excess and file to size, holding the wire in a vise, if one is available. The other five ventilators can be made from common pins. Hold the head in the cutting jaws of the phers but not tight enough to cut them, and bend to a right angle; then cut to length. The dericks and issues also can be made of pins comented in place. Make the masts of 1/04 in diameter soft wire. While the pieces are long, hold them on the bench or worktable and taper them with a file.



Side view and deck plan, how and steep views, details of some of the steep fittings a perspective above the underside of the steep, the three steep in making flaving from hairpins, and a suggestion for a water line haut that given the model the appearance of being affect

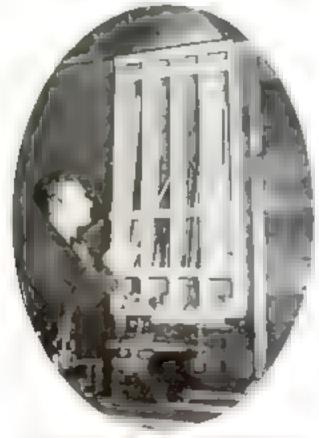




Side view of the hall black alone, with a cress section above in dotted lines; details of all the other principal units, and an explanenery sketch of the bridge structure. A scale is inches is also given so that any dimensions not expressly stated can be found accurately

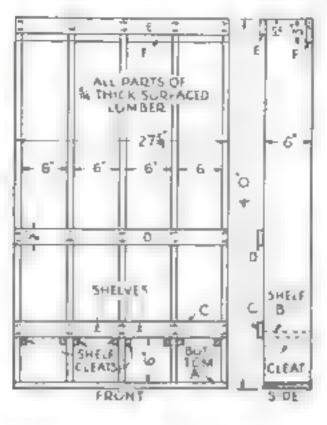
FEBRUARY, 1933

Compact Home Workshop Rack Holds Variety of Metal Stock



Meigh stock of many sleet and angibe can be kept nest y arranged in this well rack

Take problem of keeping long and short pieces of unused stock together in the workshop may be solved by a rack like



that shown in the accompanying photograph and drawing. Simple and easily constructed, the rack takes up little room and allows a quick choice of any of its contents.

Both the size and number of compartments are determined by the amount and kind of material it is to hold. The lower part from bottom A to shelf B is for pieces of stock too short to be held in an upright position by crosspiece D. Longer pieces stand upright on shelf B and are held in place by crosspieces D and E. The distance between C and D should be about one quarter of the distance between C and E.

The rack, which needs no back, is fastened to the wall by means of crosspace F. Thus is set into the rack divisions as shown in the drawing. If the rack is to hold a heavy load, it may be necessary to fasten a clear to the wall benea h the rack.—Altrick S. Claus.

DOOR STOP IMPROVISED FROM TOBACCO CAN



SERVICEABLE rubber wedges for hothing doors open are sold, but in an emergency a satisfactory substitute can be made as shown above Rip the cover off an empty lobacco can and press the open end into a slow, tapeting wedge. Cut a rubber band about 3 is, wide from an old inner tune of small size and work it over the can

CLAMPS AID IN TRUING SMALL BENT RODS



Rolling a piece of round steel or other small straight stock on a flat surface or in V-blocks is a method commonly used to find the high and low points of a bend before straightening the piece. When this has to be done away from the bench, two mexpensive C-clamps may be used. V-oicks are filed in the back of the clamps, which are fastened to any board that happens to be at hand. The piece to be straightened is then rolled in the ticks, and the bend is checked by holding a pencil as illustrated.—W B

RAISED PANELS MADE ON JIG SAW

Witest a shaper is not available it is possible to make ornamental panels for doors, thests, or other articles on a jig saw provided it has a titing table

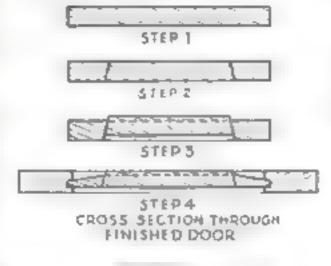
The method is as follows, although the dimensions given, of course, can be changed to suit individual requirements. A sum piece of wood is selected for the panel and surfaced on one side. Upon this face lay out accurately, in pencil the design of the raised portion of the panel. At one side of the design or in a corner if it is one having a corner, drill a hole to admit the jig-saw blade.

The table of the saw must be tilted at the proper angle, which can be determined only by trial. It depends on the thickness of the saw blade and should be such that when the cut has been finished and cleaned of sawdust and the cut-out portion is pushed up through its opening. It will project about 3/16 in, above he low portion of the panel. Make one continuous cut on the pencil line.

The background portion of I can be beveled with a hand plane if de-

sited. When this is done, glue the cutout portion in place and allow the glue to dry. The joint will be perfect

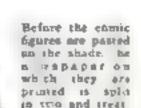
The back of the panel may now be surfaced oil so that both parts are flush and the edges are of the proper thackness to fit the grooves in the frame, in this case 5 to in.—Rogen Moyea





The raised panels of these three doors were made on the ity naw. The panel of the first door has a flat background, but the others are bevoled. Each door is 11 by 15 in. over all

CHILD'S LAMP HAS NIGHT LIGHT IN BASE



ed with paraffin

When this thique little nursery lasty is to be used as a night light, coly one of its two bulbs at turned on—a small one within the translatent base

buday rem he of ness para le saund he shade of this little samp, which was designed especially for the children's room. In addition to the novel shade there is a small bulb hidden in the translacent sase and this serves as a subdied night of the main bulb is switched off.

Since the originality of the lamp has mainly in the process that makes possible the use of the comic supplement figures, the shade will be described first. Its foundation may be any plain white or cream parchment or stretched at k shade. The one shown cost 20 cents.

As the corner are printed on both sales the paper must be split and made transit rent. To do this, cut from a coursed supplement a number of rectangles containing the figures desired, Coat each one thoraughly on both sines with a good grade of paste, and place a piece of white cutton coth on each sine. Rab well all over to pasure the cloth's sticking to the paper and put aside to dry. The two pieces of cloth may then be carefully pulled apart and one aide of the paper will be found sticking to each. Any difficulty encountered n doing this will be due to the fact that the coth has not been thoroughly pasted to the patter

After spetting the paper snok it in

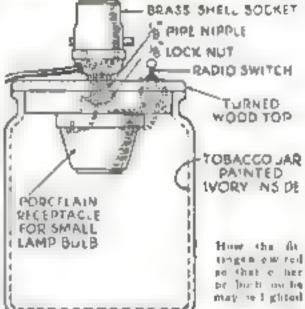


The schaces per base and the turned wooden top with the wickets and ministrate aware.

warm water up a it can be removed from the cloth, and spread it face down on a blotter to day. Next, dip the pieces in melted paraflin and trop out the surplus varafin with a hot from on a blotter or a piece of cardboard

The figures should now be cut out carefully along their outline. A little girl of the paper-doll age can do this nicely. The properties are then pasted in the desired order around the shade. A this coat of shellar completes the shade

The base of the lamp is a one-pound glass tobacco jar, evenly coated on the name with white or ivory paint. Pour a little thin point in the jar, roll it until the surface is all covered, and stand the jar up-me down on a couple of stacks to drain. If desired, figures like those on the shade may be pasted around the base.



The top is turned from any available wood to fit the jar. The method of mounting the sockets and switch is shown in the orawing. The small switch controling the lamp in the base is a miniature switch of the type used on radio panels. The wiring amows either the base of upper light a one, or both together, to be used. After wiring, saint or enames the wooden top to match the base—LEE M. KLINEFELTER

SCRAPING AQUARIUM WALLS CLEAN



A taken blade does a good job of scraping the unsightly green growth from the walls of an aquarum, but ordinary holdcts are too short and clumsy for this use It is better to make a scrapte ben wire holder for the rozer blade like that alustrated, because a will set you do the job with the least possible disturbance to the tish. Besides, the wise handle can be made any length necessary to reach to the bottom of the aquarium. The ordinary galvanized wire sold on small spools is suffi-

creatly strong if the handle portion is twisted as shown.-A. P. L.



Scraping the walls of an aquazing with a record blade. The clamping end of the wire he'der in bent as shown in the drawing

SAFER WAY OF SETTING LADDER AGAINST POLE



Inner tubes wrapped around the top rung to prevent sipping

Ir is not safe to rest the top rung of a ladder against a tall pole or post, yet there are times when it must be done. To make it less hazardous Wrap strips of an old inner tub. about the rung as shown at the left and he or wire them tightly in place. There should be a 2- or 3-in. space between

them so that the rung uself will be in contact with the pole. The rubber bindings, if tight enough, will prevent the ladder from slipping sideways.—P. W BENTLEY, Jr.

"Snowshoe Making Is Easy"



Material for Box 2. Straight grams of second growth beckery—I pain, by 6 ft. 4 in. and (for cross pc. 32 by 3 in by 2 ft.

Trimpiate. Fold sheet of wrapping paper 15 by 36 in lengthwise in center. Mark points on fold at the following distances from one end. 7, 8½, 13, 23, 24½, and 35 in Number these points 1, 2, 3, and so on Draw lines at right angles to the fold through these points. From the fold measure on line 1, 5½, in on 2, 5½, in on 3, 6½, in, on 4, 4 in, on 5, 3½, in. On line 6 make no measurement, for this is the point where the how ends come together. Draw a smooth curve through these points. Cut out and unfold template

Bending Form. Use scrap wood at least 34 in. thick. Trace template on wood and

cut to line

Boses R.p the 1 by 2 in by 8 ft 4 in piece into two pieces 1 by 1 in, by 8 ft 4 in, and dress each to 1/1 by 1/4 in, by 8 ft 4 in. Mark the top and bottom of

each piece on the edge grain, keeping the flat grain for the inside and outside. On the top (see diagram) draw a center line and lay off a space 11 in, each side of it. From the inside edge measure out on the center line 1/4 in, and connect to the outside at the 11-m marks. Draw cross lines 10 in from each end and connect the inside ends to points 1/4 in in from the outside on the end. Dress to these lines

If the toe is to be bent up a little the underside or bottom will have to be thinned sheltly. Do not make the toe less than 34 in, thick at the very center and cut away not more than 10 in, each side of the center.

Lay out mortise holes for the cross-

pieces on the inside of each piece. From the center, measure 10½ and 11¾ in and draw lines as shown; from the second line, measure 15½ and 16¾ in and draw lines. Repeat on other side of center line, Mortises are ¼ in, wide and ¾ in, deep, and placed in the center of the thickness of the piece. Trim off all sharp edges.

Steam Box. Inside measurements, 2 by 2 in by 8 ft 5 in.; made of any kind of wood naded together and with one end left off so that the bow can be put in. Bore a bole in the toose end large enough to fit a short length of garden hose. The nais in the end should be left projecting so they can be pulled out the second time you use the box

Steaming Fit the rubber hose over the

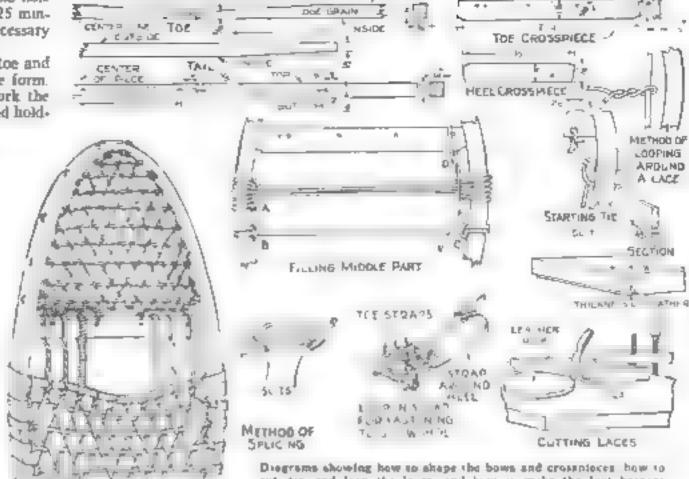
spout of a large teakettle and in the hole in the box end. Steam from 15 to 25 minutes, replemshing the water as necessary to maintain a good flow

Bendung, Start the bend at the toe and bend gently but quickly around the form. Clamp the ends together; then work the how down by taking up the ilack and hold-

ing with another clamp until he bow is snug around the form, Dry from 24 to 36 hours,

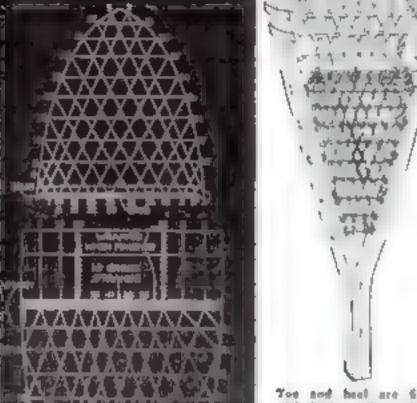
Riveting must be done before removing the clamps. Drula hole 1 m. from the end and insert a 1% in. long rivet Put a washer on rivet before heading over, A second rivet in put in 5 in, from the first, but is beaded on the opposite aide. Remove bow from form

Crosspicces. R.p the 1/2 by 3 in, by 2 ft, piece in two and dress each piece to 36 by 154 in, by 2 ft. The toe pieces are cut 1234 in, long, topered on the ends 1/16 in, toward the front; the heels are 71/2 in. long, bevoled 1/16 in. toward the heel. The top and bottom are tapered to 1/4 in. or to fit the mortises. On the longer edges laper the ends until they



THE WILLS

cut, tre, and loop the laces, and how to make the four harness



You not beel are filled with In its wide towhide. the middle part with \$4 in. wide strips. The numbers on the diagram at selt show how the straps are taken from paint to point

Wereght upg-471	Length	Most h	Tue rule prince -	tier ha piece	Suitable for the by	
125	42	52	9	6	Boys and gira	
145	42	1.8	0	7	Older lays and young women	
160	45	13	10	7	Men and women	
175	45	14	11% [7	Men and women	
190	45	15	10	9	Men	
200	48	15	11%	91/4	Men	

fit the mostises. Leave the front of the toe and the track of the heel nece straight

Draw lines 36 in, from the straight erges and parallel o them. On the ue pieces measure from the left end 14, 14 434 8 and 11 and rink 3 to m. holes at these points. The heel measurements are 1, \$14,

e and 6' and from the left end.

Assembly, Sets of 3/16-in, holes are drilled in pairs 1/2 in, apart through the how from the outside at both toe and heel. Measure 34 in, each side of center of toe and drill two sets. At a point I in. from the toe crosspaces, drill another set. Divide the remaining distance into four equal parts and drill three more sets. Do the same on the other side of the toc-

The first beel set is drilled 1/2 in, back from the crosspiece. The distance from these holes to the point where the how comes together is divided into four equal parts and three more sets drilled

These holes are to receive the starting lace, which is tied at each pair as shown in the detail marked "starting to: "

The fiding laces are looped around this lace and do not pass through the holes.

Set the crosspieces into the martises. Final Bending. Make a form of scrapwood large enough to cover the whose too section of the shoe. This can be made of three 14 in. thick pieces nailed together so that the bottom piece projects at least 2 in, beyond the others, Plane a curve on the toppieces starting from 4 to 4 🖏 in from the end, this should correspond to the upward bend the fee is to take

Clamp the bow upside down on top of the form. If one jaw of a clamp is piaced under the projection of the horton piece and the other on top of the toe center, the desired curve can be ber-The steaming is done by placing the for in a tub of bot water and boiling for 15 or 20 minutes.

When the wood is dry, sandpaper it

and apply a rout of shellac, The three sections of the shoes-toe, moddle, and heel—are filled separately

with tuwhide. The harness for fastening the shoe to the foot can be made of any soft but tough leather, or it may be hought from any large sporting goods dealer.

A long step-by-step explanation of how to opply the filling will be sent free to any reader who incloses a self-addressed and stamped envelope. Ask for Home Workshop Bulletin No. 14.

A Tiny Hidden Pump Throws Glittering Jets

Ornamental Indoor



It is intended primarily for use in a sun room or on an inclosed porch, but, being portable, it may be placed wherever suitable electric connections are available. Set up in a store window surrounded by potted plants, it wall prove a never-failing source of attraction. It makes a beautiful centerpece, loo, for a large thing room table.

When set up it runs for hours without attention and is so silent that the slight hum of the motor is practically drowned by the pleasant unkee of the water. If the foun ain is constructed with reasonable care, it should not leak a drop, even after long continued use

The small centrifugal pump and the motor are flexibly connected by means of a snort length of rubber bose taken from an old foot pump. They are mounted on wooden blocks that test on a piece of sponge rubber kneeling pad. Two flathead wood acrews secure the principal base

brock to the bottom of the fountain base as shown in the drawings. A sliding door forms one of the eight sides of the base so that the motor and pump may be oiled or adjusted. Flexible rubber hose leads the water from the inlet to the pump and from the pump to the fountain jet. There is no direct metalic connection between the basin of the fountain and the motor pump, and the water lying in the basin effectively deaders any a trat ons.

The small but efficient centrifugal pump is less than 3 in, in diameter It is machined from gunnetal castings, and the shaft is of rustiess steel. This type of pump may be obtained in fin shed form ready for use, or the various parts may be purchased machined ready for assembly, or complete sets of

tastings and parts together with bluepinsts may be had quite reasonably. Anyone who enjoys making models and who understands the use of a small engine lathe will find it comparatively easy to make the pump from castings, which is what the writer dail

With the motor running at top speed, the pump will throw three jets of water from 8 to 10 ft, high, each jet being 1/16 in. In diameter, or it will throw twenty-five 1/16 in, diameter jets from 17 to 74 in, high, the height of the jets being controlled to avoid drops splashing outside the basin, jets from 8 to about 18 in, high are suitable for the diameter of the basin shown. The higher the jets, the larger the further basin must be

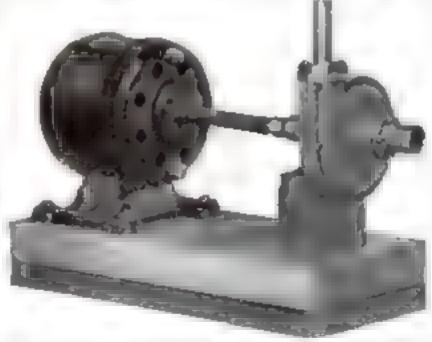
The motor used is a battery motor made by one of the best manufacturers of such products. A toy train transformer connected to the house behting circuit furnishes the current. The advantage of this combination is that the tapped transformer allows various motor speeds so that the height of the jets may be controlled. A small A. C. motor may be connected directly to the pump and run without any transformer, if preferred. It is also possible to adapt very small fan motors to run the pump, the large base or standard being removed and the shaft connected directly to the pump with the flexible hose coupling. Small toy battery motors of an inexpensive type, however, are not suitable since they are not designed for continuous running and usually are far from suent.

Whatever motor you decide to use, be suce that it has good bronze bearings and that the armature is well be anced to run with little or no vibration. The pump requires very little power so that the smallest sizes of motors commonly sold, provided they are of the better grade, are suitable for a fountain as small as that shown

The base and basin preferably should be made of some nonrusting metal of No 24 or 26 B. & S. gage—copper, brass

monel metal, or possibly one of the new rustless steels. Any of these may be soldered with soft solder The fountain illustrated is of monel metal. As may be seen from the drawings, the entite structure, except for the bottom of the basin, is made from comparatively small pieces to facilitate construction in the home shop. Methods of folding over the edges and doing the other operations have been previously described (P.S.M., Apr. '30, p. 81, and June '31, p. 116)

The only new operation involved is that of turning the upper edge of the basin outward and over a thick wire to form a rounded edge. This is done with a wooden forming mailet as shown in the drawings. The wire which should be about 3/16 in



The flexibly coupled motor and pump are fixed on a wooden haseboard, which, in turn, is set on a spenge rubber kereing pad

of Water from This

Fountain

By EDWARD THATCHER

thick, is bent to fit around the edge of the basin in an eight-sided shape before being applied. The two ends meet in the center under one of the rounded-over edges. This wire preferably should be of the same metal as the fountain.

First assemble motor and pump on the wooden base block as compactly as possible with the motor and pump shafts exactly in line. The flexible coupling should not be too short and should fit the shafts very tightly or be cemented on. When this assembly is completed, test it to see that it works satisfactorily, making temporary hose connections to the pump and using a large tin can an a reservoir

Next build the pump bousing Turn up the flaps at the edge of bottom A over a wooden block, unless you prefer to cut all the parts for the housing and basin and take them to your thannth to have them forded on his har folder. Next cut the seven sidepteres B. The eighth side is used as a door and has folded strips of the soldered across the top and bottom as shown. A folded strip is soldered to the housing of each side of this door to form slides. Solder the parts together, adding one side at a time. Use a very heavy



Looking through the door in the best of the feetale and, shows, the parts of the pemp

soldering capper, well trained and him of the flap on one size of each piece B as a over the edge of the next piece when sodered in place. All soldering may be done on the mode of both housing and basin encept in protong the hasin to the housing

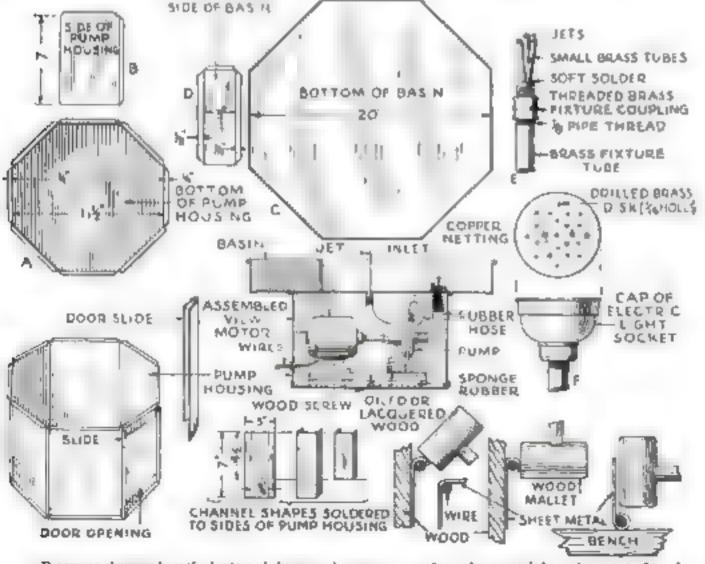
I'we hales should be justified in the bottom of the bons of for the two screws who he pass up through the spenge rabber on a the block holding motor and past,

The bottom C of the basin is the flat eight-smed one e of abort metal, to which be eight for-led pieces D are sold red. The wire is put in the apper edge after the basin is soldered. A close fitting hor should be made in the center of the following and for the jet pape, and another surely sociated for the rulet pipe to the pump. The speciate soldered to the pump housing, and a small disk of copper mosquita netting in

soldered over the in et pipe. The soft rubber bose connecting the pump to the jet and met should fit lightly.

The upper end of the fet ope should be threaded with in, pipe threads so that different types of nuszles may be tried and the most desir thie chosen. Ones, two-, or three-jet nozdes may be made hy so lering shor lengths of brass or comper taking of about 1 to a man comment c in the cho of our of the threaded brass couplings used in electric agh features a shown at E. These countries, tige her with short threaten) a gibs of threaded brass tune are obtainable wherever electrical frags are sold A spray head also may be made from the cap of an electric right socket with a drilled disk of metal suldered over it as shown at F As this is also threaded with 16-in, pipe threads, it will fit the jet pipe

Another variation would be a single jet thrown straight up so as to keep a celluloid hall tossing in the air. In that case, a small wire basket should be soldered to the pipe to catch the ball when the togentain is turned off



Desgrams showing how the basin and the pump housing are cut from sheet metal, how the upper edge of the basic is turned over a thick wire, how the pump and motor are mounted, and how the jets are made

Short Cuts for Car Owners

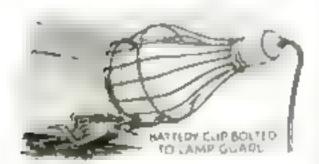
Clever Ideas Contributed by Our Readers Will Make Many Hard Auto Jobs Lasy

ARAGE doors baying independe flour and centing catches can be opened with one hand if they are equipped with the simple lever ar-

rangement illustrated. The handle, what can be shaped from a 34 by 2 by 12 in piece of wood, is prvoted on a heavy screw driven into the door and is connected by means of strong wires to the two bolt entenes. The hole for the payot should be druled slightty larger than the screw, A downward pull of the conveniently placed lever releases both bolts simuitaneously and eliminates all the "reach-ing up and stooping down" that is generally necessary to disengage the separate catches.-E. H.



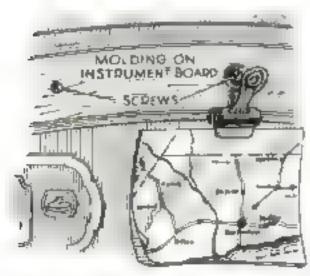
Buttery Clip Improves Your Extension Light



Battory controlling to platfacked to the top of the wolf guerd an an extension who en ables you to lasten the samp as any angle

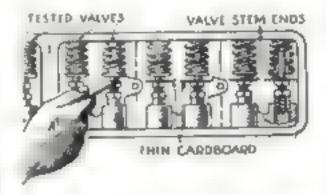
Keeps Map in Sight

SPRING paper clip fastened to the dashboard forms a convenient holder for maps or shopping lists. Remove one of the dashboard or dashboard moking screws, slip it through one loop of the place, Being smad, the clis will not be noticed when it is not in use. Doct its price salesmen will fir lot a convenier. way to keep their calling list in sight for easy reference-W A



Clip featened to deshbeard will hold read map

WHEN working under a car a good extension light is an indispensible part of the repair kit. In most cases, the bulb is litted with a wire guard having a convenient book for suspending the lamp from convenient projections. A lamp of this type while handy, can be greatly in proved, however, by the addition of an ordinary battery connection clip. The clip is attached to the top of the wire guard and makes it possible to fasten the lamp anywhere and at any angle that you may desire.-- E. L.

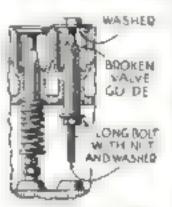


Finding Valve Tap

HIT or miss judgment in locating a valve tap can be replaced by a simple test made with squares of thin cardboard. Cut the covers from several paper match books into one-mch squares and slip one square between each valve stem and its corresponding tappet or arm Then start the motor and allow it to run at idling speed. With the cardboard squares in place, the valves will be comparatively quiet. By removing the squares one at a time, bowever a poorly adjusted valve will soon reveal itself by its telltale tap. When a noisy valve is detected it should be adjusted before the next one is tested. Any noise present when the cardboard is removed from under a tappet can then be credited to that particular vanc -E M

Broken Valve Guide

NOW and then when doing a valve job on a car, a valve guide will break off a short distance below the top. On cars



Bost not and wash. ere used to remi va braken valve guide

having the particalar valve arrangemen shown the portion that 71 mains in the engare block can be removed with a bolt, put, and two washers. The holt, with a washer larger than the valve opening under its head, is dropped down through the guide. Then the second washer as

slipped over the lower end of the bolt and the aut screwed into place. Tightening the nut slowly forces the valve guide upwith the fingers.-- J. M.

Running Board Repair

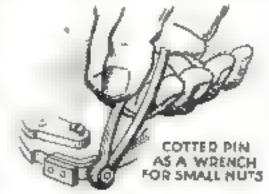
MANY cars are now provided with stordy metal running beards coveten with rubber matting. If for some reason, the curbet becomes cut, ripped, or worm a complete replacement is usually in order



However, a good repair can be made with tire cut filling compound. The damaged spot is first scraped and then washed with gasuline. When it is clean, a thick cont of the rubbery paste is applied. Since compounds of this type lend to shrink slightly several applications may be required to make the patch.-C. M.

Cotter Pin Wrench

HAVING no wrench suitable for the small nuts found on many distributors, the amateur mechanic will find that a large cutter pio can be made to serve the purpose. By apreading the legs of the cotter pin, the eye can be shipped over the sides of the nut. Pressing the legs together will contract the eye and grip the nut allowing easy adjustment.—R. A.



By spreading the legs of a cotter pic, its head can be used to anscrew distributor nuts

Where space is at a premain and a table is needed, whether in the small katchen, kitchenette, shop, or boat cabin, a folding table like that illustrated will fill the need. This table, when lowered into position, is absolutely rigid, yet its construction is simple. It works perfectly and has one great ad-

vantage over many takes of this type in that it cannot slip while in use

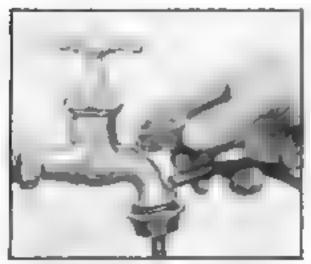
The dimensions are given in the drawings, except the length, which is governed by the size of the top required. The one shown has a top 16 by 32 in., made from 34-in stock. Inlaid linoleum is cemented to the top with waterproof casein plue.

In constructing the framework the dimensions for the various parts must be closely followed, and before assembly they should be tested so that all slides and pivots work loosely. The parts should be finished before assembly, the finish depending upon the purpose for which the table is to be used and the surrounding furnishings.

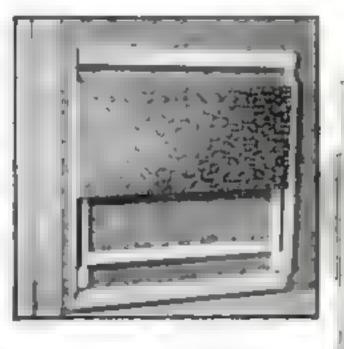
The unit should be fastened to the wall so that the top, in its lowered position, is from 30 to 32 in. from the floor, unless it is intended for some special purpose which requires it to be higher or lower. When used only as a worktable, it pays to have it fairly high—John M. Chittenden

ATTACHING RUBBER TUBE TO ORDINARY FAUCET

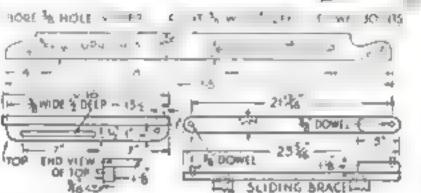
THE home photographer or experimenter wal find many uses for a small rubber tube that can be connected and disconnected quickly and easily from a standard faucet, It is convenient for filing and washing small bottles and for filling trays Take a common rubber bottle cap of the type illustrated below and cut out the central core down to the bottom. Remove the graser ferrule from an ordinary lead pencil, push out the rubber and the bit of wood left in ft, and Insert half the ferrule into the tubing and the other half into a bole made in the center of the cap. A piece of brass or glass tubing may be used in place of the ferrule, Push the cap murly and tightly over the threads of the faucet as shown.-F B



A common rubber bottle cap is used to connect the small area tubing with the funcet



KITCHEN WORKTABLE FOLDS FLAT AGAINST WALL



This folding table is especially useful in a hitchenoite in the cab a of a small beat, of in any other restricted place

At the left are dimensioned drawings of all parts but the top which to 16 is wide and of any resentable angih

DEPTH GAGE FOR SMALL CIRCULAR SAW

It is comparatively easy to calibrate most small circular saws for depth of cut by following the method illustrated at the end of this article. From an old rule cut a

MAKE USE OF OUR

Blueprint Service

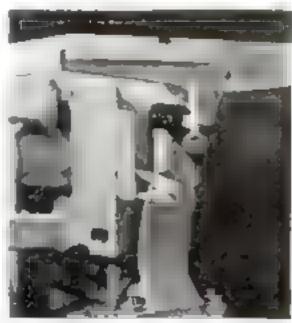
What are you going to build next in your home workshop? Whatever it is, look first at the list of Popular Science Monthly blueprints on page 94 to see if the subject is mentioned there. If it is, it will pay you to obtain the blueprints or blueprints. They contain tested designs and have been used successfully by thousands of other readers, and they will go far toward insuring your success.

You will also find the list useful for suggesting projects when you are in doubt as to what to construct next.

A more complete list is given in our blueprint folder, which contains a brief description of all the projects. It can be had for the asking, provided you inclose a self-addressed and stamped envelope.

Reprints of our best model making articles are also available for 25 cents each. They are indicated on the blueprint list by the letter "R." 355-in, piece, and drill it for screws, Drill and tap either the moving or the fixed part of the saw base, depending on which is more convenient, and attach the scale with machine screws. Cut two pointers from sheet iron 1 16 in, thick, bend them as necessary, and attach them to the other base member with a single screw,

To locate the zero position, lower the saw until, when turned by hand, it just scratches a board laid on the table. Set one pointer at the end of the scale. Set the other pointer similarly to correspond to the shorter radius of the dado saw Clamp the pointers tightly, and readjust, if necessary, by tapping them with a hammer. The pointers are easily readjusted from time to time to compensate for the reduction in diameter of the saws caused by filing.—Enwix M. Love.



The pointers and scale allow the saw to be adjusted to so sustant for any depth of cut

Photo Problems

and how to solve them by

FLASHLIGHT

By FREDERICK D. RYDER, JR.



ind appears in the picture just about the eye would see it. Through the win-

dow the bouse and tree on the opposite side of the street are clearly visthe, yet objects inside the room also stand out. The human eve sees the actual scene this way because it has an astounding capacity for registering extremes of light and shade—far beyond that of any photographic films or plates

Try this picture with nothing but daylight for dumination and no matter how you juggle the exposure, either the window will appear as a blank white rectangle or else everything inside the room will be as black as

patch.

The solution is a photoffash lamp touched off to light the interior while daylight regusters the scene through the window. Of course, the shutter should be open only long enough to touch off the flash, otherwise the view (brough the window will be overemosed. It is best to try shots age this on coudy days unless you are expert at handing he shutter and photoffash re-ease but on or you have a synchronizing device

views that include windows, it is common practice, when daylight is the only source of light, to make ninety-five percent

in ordinary interior

of the correct exposure with the dark shades drawn and then open the shutter again for the remaining five percent after the shades have been run up.

Experts can do beautiful work this way, but it takes experience in judging light values. The amateur will be much more certain of good results in taking interior views if he uses a photoflash lamp or two to get the shot. Forget that sunlight is

for Family Group Photographs

pretate taking game. I shoot a red of him and when I look over the prints. I can are with half ah eye at the thors I be ad have done to tore I pressed the but-

The a nothing to worry about," I told him l'acking flaws in your own pictures and studying what you should have fong to reake them bet tet is a sure sign that you are going to importive."

If you are a beginner, remember, too, that a

whether results will come
up to expect at one is one
of the fascinations of the
game, adding to the zest

Of course, if your photography is confined to outdoor snapshots, your chief worry will be the matter of proper exposure, Indoors, the problem of correct timing can be eliminated by using flashight. With the photoflash lamp, for instance, you can be certain that your film will receive exactly the right amount of light every time.

In previous articles, I have discussed

A little in see or \$50 and five other each anords amounted to \$100 in all, and thered by the the best family out planting upon taken an above. The picture we be used on the empty and the natural erange out the glorid and the natural erange out the glorid and the natural erange.

At the c d difficult exist take not group pick result the house has a been users me by the normalization of photosillab both who make no make a his are the result and do not are to the result of the protect of stended prima to the contest a stended prima to the contest as stended prima to the contest and the contest as stended prima to the contest as stended prima to the contest and the contest and

FIRST AWARD 503
SECOND AWARD 75
THIRD AWARD 77
FOURTH, PIFTH, and SIXTH AWARDS, 55 each 71
THE FOURTH TO THE TOTAL TO THE

age with the board of the consocialist to the angle of other Homototics of these to need

has he done by a cortex nall had be proceed in the national frame by a cortex nall had be proceed in the name of the name of the name of the Name of the Philippine and the name of the na

Non A the Bit pres on Maria I for a major of the bit of

It am wall the negative or

In near all set a exact and at more of the end of a part of the end of the en

the unique advantages of the photodash for taking pictures of habies, children, and animal pets. In this field it has no rival. Most amateur photographers do not realize that the photodash is, in some ways, better than any other source of light even for the portraiture of grown-ups, interior views, and various still life subjects.

Suppose, for example, you wish to take a picture such as the one on this page. This

How an advertisement brought Marge TWICE AS MUCH FUN WITH HER CAM

HAT THERE GE MAZDA NOT E DESEAUTION AS DO



THEM JA K KEEPS THEM ON THE RES MARY MARY NO MARLE. THE RES MAPLY MARY NOON PATORES WE'VE TAKEN WITH THEM



F PST, I WANT TO SHOW YOU HOW EASY THE TE WAT C NEW JAMPS ARE TO I SE SET TOUR CAMERA FOR "T ME" OFEN THE SHUTTER, FLASH THE THAY S ALL THERE IS TO IT.







AND THIS IS ONE OF THE IN-DOOR PICTURES MARGE TOOK



For indoor snapshots and this lamp



For time exposores. ane this famp

Here are a few of the many picture subjects there two lamps open to you

Night deigh non-Night skating part co. Carentine parties Berthday parties

Assurer area Buch 8000 He we perfruite

At at the e pe ture, including Marge's endone inepikot, were taken with G. E. Mazda Photoflack lamps

PHOTOFLASH

For action pictures

case is a section as a set of them outdoors is used G. E. 1147.0 A Photofin h lamps to a converse The expertate s reply, in highe socket or handy flashlight battery reflector.

Ask your dealer about these two amazing picture-taking lamps. Better still, get some lamps and take some prize pictures. General Electric Company, Nela Park, Cleveland, O.

PHOTOFLOOD

For time exposures

To snap act on scenes, but expers, parties, INDOORS, as For time exposures, portraits, and interiors, use G. E. MAZDA Photofood lamps. Their powerful, communicati bight produces beautiful, crisp pictures. And they are also the best lamps ever developed for taking home movies.





streaming through the windows and shoot, he flash as though it were night. Open the shutter only long enough to touch off the tlash.

In pictures of this type hold the photolish lamp to one side and above the camera so as to illuminate everything as uniformly as possible. For all close-up pictures of specific objects, whether humans, animals, or still life subjects, the flash amp should be carefully placed to give shadows that will make the object stand out from the background. This can best be done by holding a 100-watt light in various positions while you study the effect.

WATCH carefully for unwanted reflections. Any glass surface, in fact any shiny surface—even such a dark object as polished manogany—may reflect from the photofiash into the lens and so spoil the picture.

The first of the two postraits at the top of this page was made with the aid of a photoflash lamp. The ordinary bulb in the reading light was removed and a photoflood bulb substituted. This is a good trick in any case where it is desirable that a lamp in the picture area appear brightly lighted. The photoflood is so strong that it will give the proper effect during the brief time the shutter is open for the flash.

To show what a bad reflection can do I took the same view again, but moved the photoflash lamp over a bit so that the light reflected directly from the hanging mirror into the lens. The resulting glare, as you can see in right-hand illustration, fagged out the whole upper portion of the necture.

Because a mirror is such a perfect

reflector, it causes the worst glare. The glass in a picture or window frame is not quite so bad. Broad varnished or enameled surfaces produce less intense glare but because of the irregularities in the surface, a large area outside the true point of reflection also picks up light.

The spreading of the bright spot over areas not actually receiving any undue amount of light is known as halation and as worst with single-coated glass plates. Modern, fast, double-coated, dyed back amateur roll films and film packs such as verichrome are least subject to halation to any indoor photoflash pictures where there are intense bright spots such as sunlight streaming in a window or gleaming reflections from polished metals or glass ware the use of the modern double-coated film will help to get clearer and better pictures.

Enresight in photography includes mak

atton. This applies to photellish lat i

I ke any other electric buts ther
is a chance that exits prough to

if the flash

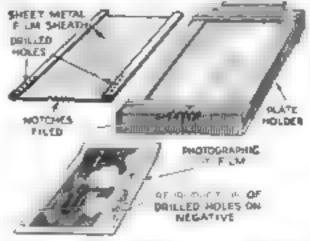
Vibough the clerk beauti the photo of inventate will grow in a success fast a and tell you it can the long if you

an, peversheless, be done—and up to simply, too. It is easy to make sure that the filament is intact without touching off the flash. How this is done is shown in the illustration at the left

70U need a socket for electric light You need a monature lamps, three hulbs, one for miniature lamps, three I ft long pieces of insulated wire, and one flashlight bulb. Connect one terminal of one socket to one terminal of the other socket, then clamp the remaining two pieces of wire to the remaining terminals of the two sockets. Screw the photoflash lamp to be tested into the large socket and put the miniature bulb is the little socket. Now touch one of the bared wire ends to the base of one cell taken from the handle of the photofash lamp, Touch the other wire end to the small brass cap on the other end of the flashlight battery If the miniature lamp glows, he photoflash builb fi ament is intact,

DOTS ON MARGIN IDENTIFY CUT FILMS

IT IS often desirable to mark on hims to distinguish their time exposures and to make it easier to identify the dates and description of the subjects being photographed. Here is an easy way of marking the films. Drill small boles on each side near the bottom of the film sheath, the number of holes progressing from one up so they can be used in rotation to correspond with the plate holders on hand. File the same trumber of notches in the lower edge of the film holder and also on an outside corner of the plate holder. The object of the notches is to be able to locate a film holder even when working in complete darkness.—Grouge Sourcem.



Small boles are dralled in the film sheeth, and both it and the plate bolder are notched

EASTMAN NEWS BULLETIN FOR THE

AMATEUR PHOTOGRAPHER

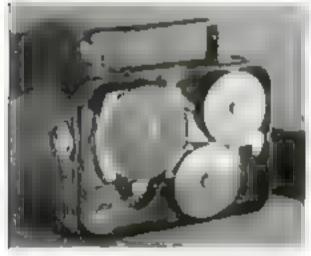
FEBRUARY 1933 PUBLISHED BY EASTMAN KODAK COMPANY



The new Cine Kodak Eight is no inexpensive that practically engage can afford it Price, only \$25.50. The film, at \$2.25 for a rate one enough for a couple. of doten scanes, gaves you movies at 10 cents a shot.



A Movie Film Comparison. At the back, a reel of tlends d professions movie film. Conter A reel of some 10 mm. amazeur film. Front The extremely temporal new 8 mm. film. All three reels run the same



Interior of the new Cine-Roda's Eight. Unto the simple files pack, the extremely compact arrangement of parts. Clud Kedak Eight is emarkably easy to operate, and slips into a cost pocket.

Madem Film Has Two Sensitive Coatings

'Two heads are better than one " So are two coatees in the film you use... They bef guard anapshot results. The two coating penciple is used in Kodak Verichrone Film to give better enapshuts and protect against both unders and overexposure. The top conting is fast, to catch the dark parts of the picture. The under coating as slow to hold the bright parts without overexposure. Working together the two coatings hold clear, crisp detail throughout the picture, even when somewhat under- or overexposed.

Make Home Movies at Ten Cents & Shot

with New \$29.50 Ciné-Kodek Using New Low Cost Film

TERE is a new Ciné-Kodak with II which you can get twenty to thirty action scenes of adequate length on a roll of film costing only \$2,25, finished and ready to show on the screen.

This remarkable movie camera works on a new principle and uses a new type of film, which is able to record sharp, detailed images in extremely small size, on a half-width of 16 mm. 61m. These images are so perfeetly formed that they can be enlarged into clear, brilliant pictures on the home size movie screen

The new Ciné-Kodak hight takes full advantage of this intorovement It uses a 25 foot roll of the new film in 16 mm, width. Ju the camera, small pictures are made along one half of the film, after which it is reloaded in the camera and pictures made along the other half. The 25 foot 16 mm film is then processed by Eastman without further cost, slit and spheed and returned as a single 50-foot 8 mm. film ready to project-equivalent in picture making time to 100 feet of 16 mm, film.

Photography a Hobby for Millions

"Als camera has been almost a 'cloctor's ргозсорнов. says one attient enthypiast It has given me an absorbing interest ograaric of my work something I needed to make me really happy. This man sexperi-colar represents the feeling of millions of picture makers. Perhaps you, too, are looking for something to add space to your lessure hours. Try photography, Joen our clan-

New European Type Kodak

From Eastman's German Jactory comes the Kodak Recomar, a camera of wale capabiltly - allowing the use of supples mentary lenses, long bellows, ground glass focasing, frame finder, and option of 🛶



tigmat lens and is available in two popular. sices-21 x 3 1 and 31 x 414 at \$40 and \$48, respectively. A booklet describing the Recomar and other Continental Kodaks will he sent you on request

February Picture Toking Notes

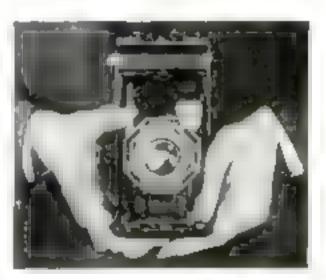
This is the season for snow pictures. Remember the use of a color piter will slow up the blue glace of the more to give other objects a better chance to register on the him and to give greater depth to shadotes on inotescoper

Don't forget that the light is weaker at this time of year. Allow double the zummer exposure for autdoor subjects other than snow wenes

Do you realise hose much color adds to inapshots? A few evenings spend with Kodak Transparent Oil or Water Coines enable you to make your pretures much mire thieresting.

Are you keeping your prints in order? Il tih a Samplex Albant you need only slep. standard sized prints underneuth raised corners and your prints are mounted in permanent form

Kost k Book Hore to Make Good Pic tueca i a central your degree s.



World's Smallest Roll Film Camera for Its Picture Size Now Has F.4.5 Luns

The Kodak Six 16 shown above is the smallest roll film camera taking a 214 x 4 octure. This camera, historica available with single, doublet, or Kodak Anastige at \$6.4 lous, is now available with the fast f.4.5 Kidak Anastigmat. The price is \$30, Kodak See 20, for 234 x 334 pictures, with similar lens is \$28. Kodak dealers have but h

INFORMATION REQUEST

Fastman Endak Company, Rochester, F. Y. Picaso wend me Hierature regarding items mentioned in your February Bolleton, as checked below.

Ciné-Eodah Eight Curé-Radelt (có mm.) 🔲

Continents' Kodaha _ Kodak Sa- 16

City

Simple Scenic Effects

THAT IMPROVE A

Model Railway

... and other hints

OST model railway enchustasts pass up the job huilding elaborate scenery because the work looks complicated and difficult. This frequently is true if intricate wooden atructuren are built for stations and so on. but if cardboard, scissors. and gluepot are used instead, the work is far sampler, less costly, and equally effective from a servic standpoint,

The cheapest varieties of cardboard-for example, the kind that is staffed in your shirt when it comes from the laundry-are as good for the Bristol board On large structures such as the warehouse illustrated, the cardboard is attached to a light framework made by ripping scrap lumber into thin strips. This iljustration plus shows how

to give the effect of a corrugated aron roof by using corrugated paper with the

grooved side appearment

The tarred paper roofs used on small sheds and outbuildings can be imitated in miniature by gluing on strips of dead black paper and pushing in small tacks at intervals to simulate the usual moting paper fasteners. The local photographer who throws away quantities of this paper, will be glad to give it to you.

Shingling on roof or side walls of a



A ce bear to As fest Quie and serves

 g v in be instared 2 2 6 4 F H . . to strips about twice as wide as you wish the exposed portion of the stungle to be. Then

rapidly slit one edge of each strip, making two cuts at each shi so that

a tiny slice of material is removed. The first cut should go straight in, the second should go straight in for a distance equal to the exposed part of the shingle and then swerve over into the other cut. Irregularity both as to the spacing of the sitts and the amount sliced from each is desirable. The photograph in the circle shows how the rows of "shingles" are glued in place. An application of real shingle stain of any desired color will then complete the job.—Thomas W. Arrolo.



Button Insulators Used on Telegraph Poles

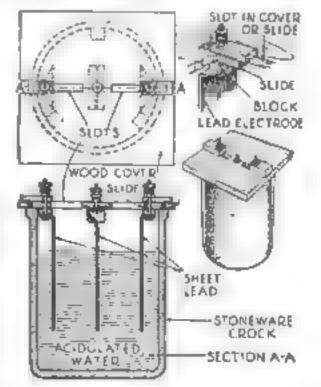
THE construction of model telephone and telegraph poles is relatively easy, but obtaining suitable insulators often is a problem. The pole above is made of dowe. rod with plots sawed into it to receive the crosspaces. Poles and crossbars should be stained by dipping before assembly. The ensulators are tiny white buttons of the type shown. These are set eyelet side up and held in place with a drop of glue.

A Two-Circuit Rheostat

THE conventional way to make a liquid recestat with one fixed and one movable plate can be improved upon as shown below, to bandle two portions of the model railway track circuit independently.

A 1-gallon stoneware crock holds the water, to which dilute surphuric acid should be added, drop by drop, till the rheostat has the resistance desired. The square wooden cover should be a list larger than the top of the crock. Fit three small wooden blocks underneath the cover to keep it in position. The fixed sheet-lead electrode is belied to the center of the cover after two slots have been jig-sawed in the positions shown. The slides, which carry the movable plates, are each made of three small blocks of wood.

The wire leading from the power transformer is connected to the fixed electrode.



Thick Fiber Board Roadbed Helps Reduce Noise



Short sample section of a roadbed that absorbs no se It is made in long strips and covered with glue and finely crushed stone

ROADBED that greatly improves A the realistic appearance of the model radroad and at the same time absorbs much of the noise of operation can be made from the thick, easily cut fiber boards now so much used as heat insulation in building operations

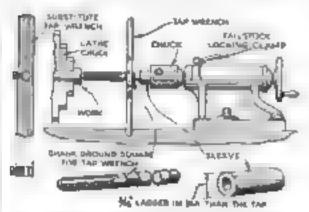
A short sample section is shown at the left. The large boards are first cut into strens and then the edges are beveled with a strong knife or a coping saw

A layer of glue is painted on, and this is covered with chicken grit, which is a finely crushed marble, or with a very fine grade of crushed bluestone, if obtainable, After the glue has set firmly, the excess chicken grit is shaken loose. -- ROBERT W HYDE.

SLEEVE SUPPORTS SMALL TAPS USED IN LATHE

WHEN it is necessary to tap small holes centrally in work held in the lathe, I find the following method aids in holding the tap in line and also reduces the danger that the tap will break. I take a piece of round cold-rolled steel or drib rod about 3/16 in. larger in diameter than the tap shank and drill a hole lengthwise through it so that it is a nice sliding fit for the tap shank. This sleeve is held in a drad chuck in the tailstock.

The shank of the tap is ground square at a point near the threaded portion so

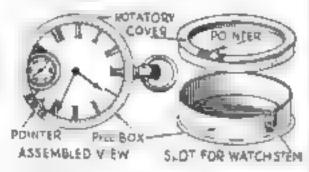


With its shank held in the sleeve, the cap th less aftery to run out of leap or brugh

that the tap wrench can be applied to it there. Then the tap is piaced in the wrench and the tap shank in the sleeve. The tailstock is moved along until the tap is up to the work, whereupon the locking screw is fastened and the tapping begun. The tapcan turn and slide, yet it is well lined up and supported

A substitute for a tap wrench can be made as shown from a piece of stock just thick enough to allow a small set screw o be used. With such a wrench it is neccausity only to grind a spot on the tap for the screw to bear against, instead of taking the trouble to grand a square section an required by the method described in the paragraph above,-D. E. Caswell.

A PILL-BOX TIMER FOR DEVELOPING PHOTOS



TIMING the development of photos with a watch and endeavoring to remember the exact minute when each should be removed, led one amateur to construct the pil-box timer illustrated

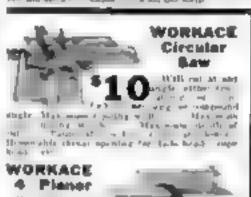
A pastehoard pill box, slightly larger than the watch, was chosen, and a disk was cut from the cover in such a way as to leave a projecting pointer, as shown. A slot was then cut in the side of the box to receive the stem of the watch

In use, the watch is set in the box, and the cover is placed over the box and turned so that the pointer indicates the time when the photo is to be removed from the developer -- G. E. HENDRICKSON



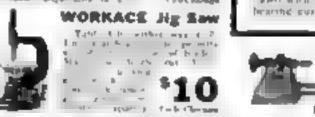
10 mg 17472

The world of the period period of the period of the period of the service of the period of the perio any other marking in its selve



High Johns Sach of the state adjo able to \$ WORKACE Hg Saw WORKACE 12" Scroll Saw

Minds speed & timer farter than fastest fly ann. Man-If sale there is the per minute figure 21 of 2. The bird of the minute to at a present the presence of the best with stands the size device and encourages Sign best branche ruste. As movim parts enclosed



WORKACE 36" Latha **WORKACE** Home Woodworker

& Mathines in Oue Compact Unit

e i p dans where it in the list much hope off the greater specimen and the state of the state the walk best of tength and

belt

Capacity over \$ tool rest of diameter Capacity over telechines fathe bed 8% diameter Ca pacity between centers 36" on splitting live center Equipped with 6" and 12 Inol rests 2and 36" V-

WOOLD'S LANGEST BUILDERS OF PORTABLE WOOD-WORKING MACHINERY





J. D. WALLACE & CO. Wilcon and Cultivaries Area. Chiange, M.

a The Minds of The State of the TO PLANTE & PO former Asia Workers Read See Westers Markers Ma Workers Read See Westers Markers Ma Workers Read See Westers F Workers In See Westers F Workers Ing See Westers Latin Plates and Complete Seeding No. 400 Taker See Today ☐ Windhace Planter N-Add on July Jilah-



"A little Slope a will soon put an end to that twitching pain?

"I hope so. I've hardly slept once the last damp spell storted."

DAMP-DAY PAINS

-stiff joints

Don't let pain keep you swake during damp weather. Warm those stiff sore joints with Sloan's-and you'll sleep coundly. For Blown's rushes (resh blond to the sure spot, kills point, relaxes stiffnosa. No rubbing is needed with Sloan's - simply pet it on. Gives the quickest relief in the world . . . and costs only 35¢!

SLOAN'S

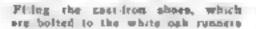
World Famous Liniment used by 133 Nations

no one can afford to buy any outboard motor until he has seen the marvelous ew developments Johnson offers in its outstanding Synchro-Control Sight Gas Gwate Taper Tube teder water trans Portage Steering Handle Certified Power tions of the f treat motors treat motors to the 1 inc. Is had which describes the describes the TONKSON MOTOR CO. Serve a Cree Serve College Co. College College Co. College College Co. College PROPERTY. JOHNSON *SEA:HORSES*

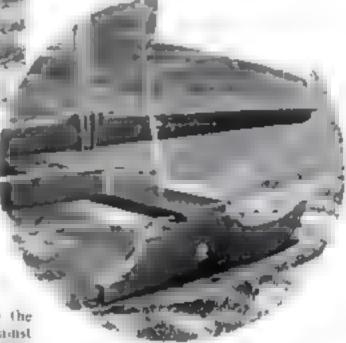
Runners, Rudder, and Sails for your ICE YACHT

By Alvin. M. Youngquist

of length) to the sharp edge of the shoes. The shoes run more smoothly if the extreme forward and the extreme after ends of the sharp edge in contact with the ice are flattened a trifle with a fire This is to prevent excessive chipping of the ice as the runners rock up and down due to arregularities of the ice surface The runners rock on a 1 2-in bolt carned through wood chocks that are builted to the runner plank. The chock blocks must be boited perfectly square with the

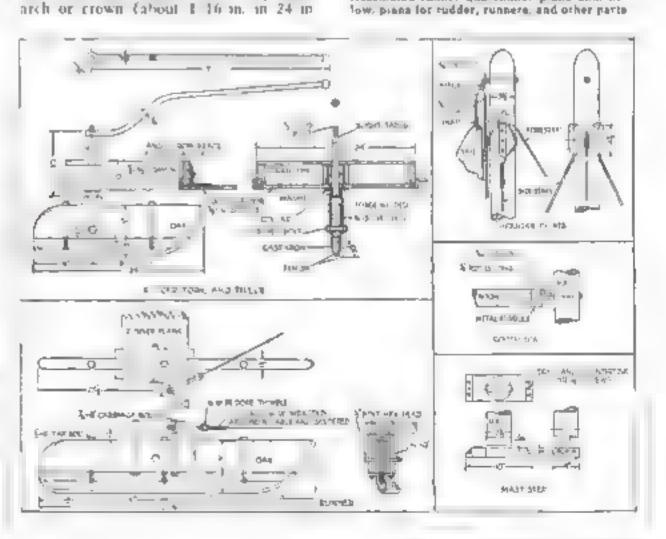


VOR a fast rasily hamiled ice 1 yacht like that described ast month (PSM Jan. 33 p. 64) a great deal depends upon the efficiency of the tunners. Cast-iron shoes builted to white oak toos make the best runners. An 80-deg angle is trachined on the bottom and it is advisable also to machine the top square to insure a tight fit against the wood. There should be a very dight



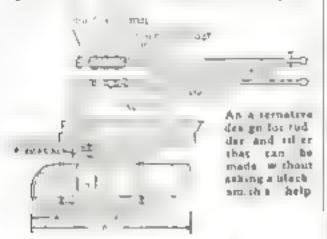
runner plank and parallel with each

Assembled tunner and tunner plant and he low, plans for sudder, runners, and other parts

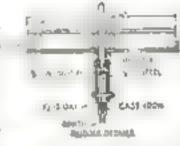


other. It is advisable to fasten the bracks completely on one end of the plank with as much accuracy as possible, but on the other end bore only the forward holes and bolt each chock with one bolt. When the boat is on the ice, push it along and adjust the runner that is partly secured until it tracks perfectly on the see with the other runner, and then bore the after holes for fastening the chocks perma-

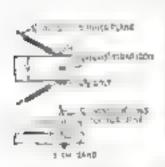
The rudder is sarnar to the forward runners, but instead of having fixed chocks it rocks on a bolt through an fron fork that is fastened to the tiller post. The fork is constructed of parts



pinned and riveted together as shown in the drawings, or it may be a best U-strap of J by 5 16 In. steel, forged to the



ti ler post. Both types of forks are shown so that the builder may select the one for which his equipment and facilities are adapted. One involves machine shop work and the other may be made by a blacksmith, Likewise, two types of tillers are shown one a sample forged Job, and the other an assembly job consisting of a turned wooden handle bolted to straps which in turn are bolted to a yoke keyed to the tiller post of the fork. The latter has one advantage in that the tiller in



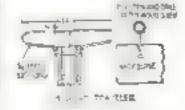
Stom bond at Iront end of backbone with staye to reneer plank

hinged by means of the one bult through the straps and yoke and may therefore be raised or lowered the position hasist convenient fur the belmsman

A short, staff spring or a rubber collar placed over the tuler post under the back-

bone to relieve somewhat the jar from rough ice is desirable but not essential. Ir and, a steel colar may be used

The sams szould be made of closely woven 7- or 8-oz sail corton and should be nound. with 5 16-m. manils rope on all sides There (Continued on page 87)



Sect on of backbone glowing , b sheet travieler and an enu view of thus simple attachment

New Scroll Saw Makes Splendid Record



SINCE its introduction but year this new model "Delta" Scroll Saw, radically different in design, has been installed in many thousands of woodworking shops, bome workshops, schools, jiesaw puzzle factories all over the United States. Everywhere ft has made splendid records of achievement. Everywhere it has won the deep praise and unbounded

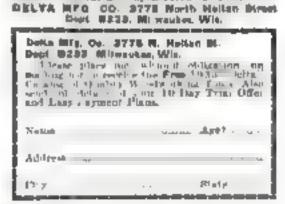
admiration of woodworkers.

And no wonder! Its unique detign and careful construction enable this saw to run at full motor speed with all springing and twisting eliminated. At 1,800 strokes per minute it has such perfect balance, such absence of vibration, that a pencil can be stood on end on the saw table without tipping over. This is the only seror sew of this type on the market today that can pass the rigid test.

As a result, this amazing tool produces fine, smooth, accurate work haberto posuble only on a bandlaw. Hat 24-Inch throat capacity. Works on metal and fibre as well as wood. Can be used for filing, sanding, and boning. Priced astonishingly low, within the reach of al-For full details, send for the FREE 1933 "Delta" Catalog of Woodworking Units.

10-DAY TR

Easy Torris Remained Tiefen R. n. p. or har Toris are efficient and dense and dense are efficient as a second dense are a second dense as a second dense are a second dense as a filler of the second dense and the second description of the second description descr



A Complete Line of "DELTA" Tools "Delta" Woodworking Units are

convenient, portable, and compact All are available in a large variety of combinations and all prices to fit all occus. The "Delta the includes Jointers Corcular Sans Hand

Saws. Woodfurring Lathes. Brill Presses Scroll Sasts. Boring, Routsug, Sanding and Mortising Attachments. -and a complete line of accessories.

Shows the complete line of intest. It is packed full of Toole interes ng lumentions and de-sempriores it desembes the intest dereinforces in motor driven equipment at the astornalongly low 1913 price levels. For FRAF copy 5" out coupon at the right and mail lodge!

ASSEMBLE A BOAT THIS WINTER!

I se our completely assembled frames and machaned the formation of each assembled at home to be the case to be the c Automobile Racing—NEW BOOK

The simples of the state of the and clarability of the same of the state of the same of th

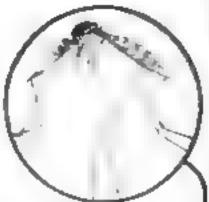
Showst ready for

A DECEMBER OF

w Frage

the all pile of

Nature's Miracles



Magnified Mesopotte

New Gem Microscope Magnifies 75 to 300 times

OBSERVE eruel bacterial life in all ests of molds, amazing botanical adapations to assure fertilization, complex ages a mineral appregates, hving broom commerces, preying municers in a drepo pend water intricate mechanism of a fly's foot, astonishing compound eyes of insects, inexhaustible thousands or ever a to decrease a series of the remaining Alon Phone by I all America, with the second of pay op-

Write for free literature

BAUSCH & LOMB OFFICAL CO., 747 St. Paul St., Rechester, N. Y.

AUSCH & LOM





Lat he bear of a spinelly approxime hellow a practice. tatlatock actorer for taper turning-rule acrew threads 4 to 90 perioch. Made as 24" to 18" bods. (used by manufacturing plants, machine shops, U. H. Convernment, and achieva

Write for Circular No. 6 describing the types of &" Beach Laskes, attachments and toule-for every kind of aloop-

Factory Behalft Letter-of Interviews, at bargain prices. Only few available. Brite for

O SOUTH DRAD LATHE WORKS 451 E. Madieon St., South Bond, Ind.



Meter Budte \$475 and sp FULL LENGTH SPRAY MAILS - SOMETHING NEW A TVT Fare, y Our hoard motor hout with all large happay rails took it by place and tame princip Mawanker-thicago Marathon.

Catalog Free-Bare Mustay Presign Shipmant Pless state lend of best in which you are instructed. THOMPSON BROS. BOAT MFS. CO. T.

CREATING NEW WORLDS WITH A MICROSCOPE

(Continued from page 47)

this part of our work, we shall need a few ounces of concentrated sulphoric and, keeping in mind that it is an active corresive agent that should touch neither the specimens nor our hands. This is placed in the bottom of a large jur Suspended from the top of the jar on rubber bands (the fumes (rom the acid will attack ordinary metals) is a small platform of clean glass. The specimen to be dired it placed on this glass and permitted to remain there for about a week-Of course, a number of specimens can be placed on the glass tack at one time, A drying far of this type is called a desiccutor.

WHEN the week has passed, we prepare our slides before the specimens are taken from the desectator. After clear or white shellar has been applied to the clean slides with the aid of the turntable, they are placed in a warm oven and left there for at least an hour. The object of this layer or circle of shellor is to provide a small specimen chamber between the slide and the clean cover glass. The rim of shelkse should be high enough to allow the cover glass to fit neatly in place over the specimen

Having progressed thus far, we now place our slides back on the turntable, one at a time, and with tweezers carefully place the specimens. Then a clean cover glass is set in place in such a way that it will be exactly concentric with the circle of shellac, Next a comel's half brush filled with thin asphaltura varnuh is brought in contact with the outer riccumference of the cover glass to seal it to the slide. The seal should be examined closely for leaks as air must not reach the specimen. If it does, the specimen will soon become moldy and ducolored and unfit for

future display. If a leak is detected, it should be ameaned with the sealing compound

By permitting each successive circle of shellic to dry and applying still another, we can build up chambers or cells susiciently high to accommodate objects of considerable size. It must be recalled, however, that these objects must be transparent or transaccent.

FROM what has been said it must not be thought that only transparent specimens can be viewed in a microscope. That would be stretching it a bit. However, when we want a real intimate view, we must be able to see through the specimen. That does not mean, for instance, that we cannot view a fly's les under the microscope. We can indeed and it often happens that merely the shadow of an object is intensely interesting. In this cutepary we might mention the edge of a razor which appears like a saw even under low magnification. A pin point, while we cannot see through it, appears blunt and resembles a crowbar when viewed at fifty diameters

in our gardens we can find countless objects that make interesting rights without much preparation. Plant lire or aphids may be examined alive under the instrument with the assurance that they will stand still for minutes at a time. They appear as wested

monsters under low power

In closure, the writer would like to address a word or two to those who would enjoy this work but who, for lack of time, cannot prepare the specimens. A large variety of specimens, already mounted by professionals, may be purchased from dealers in microscopes. When ordering, however, the amateur should make suce that he does not obtain shides that are beyond the power of his instrument.

POCKETKNIFE MODEL OF MANHATTAN

(Continued from page 65

bending the davits a little will correct the You are now ready to paint the model as soon as the water has been marked. Place the hull on a smooth table, hold a procil point on the edge of a 1/2 in, thick block, and mark all ground the contour of the hull

For best results give the complete boat a coat of flat white paint. Use a 34 in, wide flat brash for this and most of the painting, and a small round brush for the portholes and fittion. When dry, give the bottom, up to the we ter line, two coats of light red, Indian red, or light Chances red. The writer prefers to use lour-hour enamel, which thries plossy, but artisti" oli colore in tubes ur lacquers are alsii suitable. Next paint from the gunwale up with white enamel, except all the decks that are represented by the original upper surface of the bull block A These decks are buff whereas the promenade and boot decks are white

Color the smokestacks red, while, and blue as shown on the drawing. Touch the ends of the ventilators with red. The masts and small deck parts are white, which sets them off rom the boff decks. Now paint the upper odes of the hull with black enamel, and andicate the portholes with a small brush. An easy way to make the square windows is to paint a black stripe and make lines across luwhite with the small brush when the black is dry. A touch of glue painted green on the starboard or right side and red on the port or left side will serve as side lights. These are placed on top of bridge E at each end.

A simple hase can be made of 1/2 -in, wood 2 by 17 in., puinted light green. The edges should be beveled. Two thin screws driven up through the base into the hull will bold

1 production 2	,	Marrie
1.1.14 to 11s at 12.	L	White play for half a
F 26 x 135 x 576	E	White play for de-
15 n 34 n 656	L	White pine for decision C and F G and
) # 56 # S	3	White play for the new bredge and K
1732 a 86 m 19E	1	Sheet metal for out for any total or per- tern and Z
1/16 x t x 116	1	Cardboard for describe D and H
5 A 464 E 754	1	half ware in courts
stda n4	- 1	Soft when for mixing
44 dla. # 36	1.	Soft ware for davits
	20	t ommun pina for yer (linters, derricke, au leitus

the model. Another way is to cut out the center of a piece of cardboard to that the boat can be set into the opening, leaving about 1/16 in showing below the water line, Mount the cardboard on a frame as shown on page 64, and paint it light green.

Note: All dimensions are given in inches-

alon dark and light red, and bull

Repairing Harness Saves Money on Small Farms

By L. M. ROEHL

New York State Callege of Agraculture

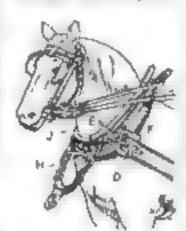
MOST communities today have no barness repair shops, and the individual farmer must up his awn barness causing oiling and of en repairing too.

The parts of the barness most frequent-

y a need of reparing are the har es. The hame map e may have to be replaced and also the hame ron that heids the hottom hame soop if it has been worn shrough.

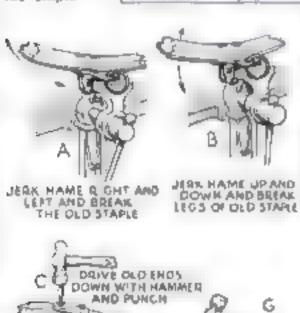
To replace a hame staple.

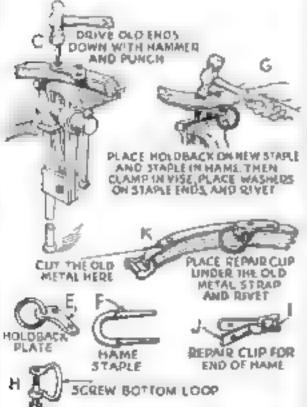
Price one stope of the stope in a machinist's or the karath's



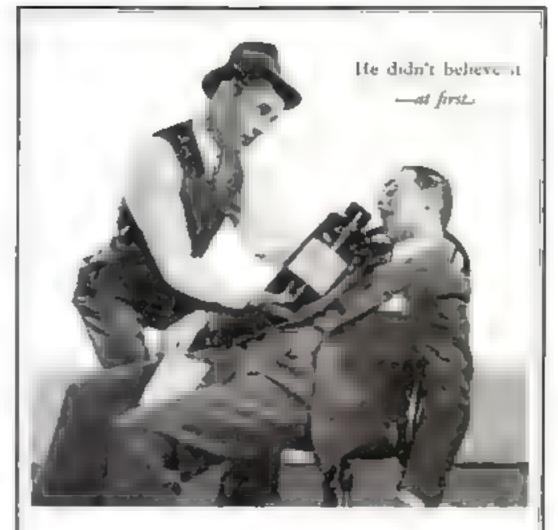
The harmens pares that most often are broken

the as shown at A below and jerk the hame vigorously right and left so as to break it if t is not worn entire through. Then terk it up and down as shown a B so as to break one har of the staple. (Continued on Juge 85)





How to repuser a were hante staple and the burne iron that holds the bottom barne loop



"Yes, I believe it"

An Open Letter from a happy man

Pl T this on your believe it or not lot. My promotion and case from reading and believing that statement: 'EVFR's hand tool needs oilstoning often

I had all the boys in the shop oilstone their mols for a few minutes one morning as an experiment. Ye gods! What a bunch of smiles! Cheerful workers, better work, faster work! Three months of this, and they gave me the big room with twice as many machines and men. I read about oilstoning in the Norton-Pike book—a brainful of the smartest dope on sharpening ever spilled on paper by some sharp who knows sharpness forward and bockward.

MOST "behave-it-ter-not" stuff (so't any use to anybody. This that pening stuff is of use to everybody except the boy with a driera and a knife. The Norton-Pike book is free to anybody who sends in the coupon below.

A Mineral Museum Worth Seeing

If you saw all the sharpening stones, grinders, wheels, etc. (it that hise hardware store downtown, all made by Normon-Pike, you would teel greedy for a previoe collection of your own. Take a look. Dealers like to show them and talk shop-talk.



BEHR MANNING CORP TROY N Y -Distributors for the US A.

I'm bourng for the Norton-Pike book, "How to Sharpen" I'm sharp enough to ask for it, since it's Free.

Author.

Alle

My deder

He mile



The old "covered wagon"

BUT NOW YOU'D WANT A LIMOUSINE

You'd much rather ride across the Continent in a modern limousine than in an old covered wagon. Why? Because the limousine has aprings, shork-absorbers, and cushions. In a word, because a limousine is infinitely more comfortable.

The same thing is tree about shaving with Squibb Shaving Cream. It's more comfortable. The creamy lather acts like a shock-absorber on your rasor . . . cushioning the rasp of the blade. Squibb's contains a special ingredient . . . a soothing halm . . . that seems to put halfbearing smoothness in shaving. And best of all, the comfort is a lasting comfort. For Squibb Shaving Cream supplies ails essential to the comfort of the skin. Try it and see how pliant, amouth, and downright antisfied your face feels.

Send 10c for a generous guestsize tube to E. R. Squibb & Sons, 2302 Squibb Building, New York City. Or get the regular over-size tube at your druggist's.

· To give yourself the last touch in clean, currented shoring, no Squish Taleum. Scanned or uncommed. Delightfully saft and ghealulely purp,



Our Construction Kits



BY SENTING 81 to Potentar belonge Home I traible you man

I construction k t raw materials for making a highly simplified 12 in. long model of the new American built lines Manbetter. The kit contains a piece of white pine for the bull, sawed to the approximate shape but otherwise unfinished, wood of the correct thicknesses for making the various deck units, bridge, funnels, lifebeats, and sumour parts sheet metal for the rudder anchors, propellers soft wire for the masts, ventilators, and davits-in fact everything but the paint A blueprint showing all parts full size is included

Because of the small sare and unusual simplicity of this miniature model, it is an excellent one for beginners and will serve as a pleasant introduction to the fascinating bobby of ship model making

This new kit is marked F in the list below It will be mailed postpaid to any trader in the United States

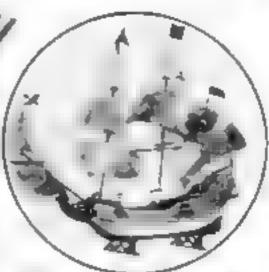
tor \$1. The other kits available are also listed. Each is accompanied by instructions or blummints.

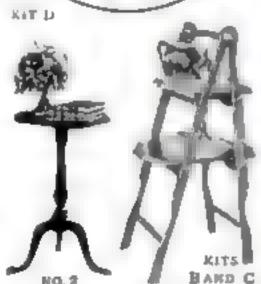
A. Whaling ship model Wanderer the raw materials—would, wire, fishing line, thain, celluloid, and everything but the paints, together with Blueprints Nos. 151, 152, 153, and 154. The hull is 20% in long..... \$6.90

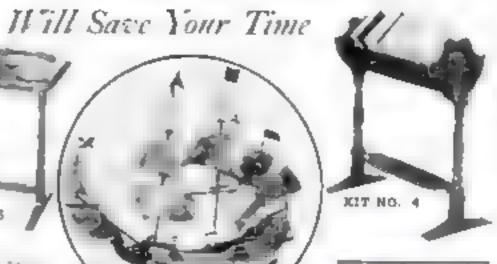
AA. Same with hull lifts sawed.... 7.40 B. Folding multin stand in selected sugar pene, 11 in. wide, 19 in. long and 33 in. high when open. All the precisity wood cut to approximate uses but not marhined ... 200 C. Same muffin stand in birch (can be

finished as maple, walnut, or mahogany) 2 90 D. Spanish Galleon ship model, 24 in. long. All the raw materials (except paints), Blueprints Nos. 46 and 47, and a booklet ... 6.45

E. Battleship model, U. S. S. Texas, J ft.











KIT F-Materials for 12-in, model of Manharren

long, All the raw materials (except paints) and Blueprints Nos. 197 to 200. 6.95

EE. Same with hull lifts sawed ... 7.45 F. Liner Manhatton, All raw materials leacept paints) for a simplified minuture model 12 in. long, and Bluepript No. 204 1 00

No. 2. So to maliocany tray top table 21 in high with a 15 in, daimeter top. Really 10 avemble 5 00 No. 3. Tilt-top coffee table in selected

maple with top 19 by 28 in., and 21 in. high Ready to assemble, 7 15 No. 4. Solid mahogany book trough 221/2 in, long, 91/2 in, wide, and 243/2 in, high over

all. Ready to assemble......... 5.30

	_
Popular Science Romecraft Guild, Mt Fourth Avenue, New York, N. Y.	
Pirose send me Kit	
which I factore farmed (or send C. O. D. D.) Mote Prices of all kits except F are 50 cents higher west of the Miss as ppi River because of heavy ab pping the gen The offer a pande only to readers to the United States.	
Name .	
Addrese	
City Ctare .	
(Po asi print name very (feet y)	

REPAIRING HARNESS

(Continued from page 83)

close to the hame. Break the other bar in the same manner

2 Open the vise about 1 in and hold he hame over the opening crosswise as shown at C; then drive the staple ends down with a hammer and punch so as to project about 1/2 in, on the riveted ends.

Cut the riveted ends off, preferably with a hack saw or bolt cutter. If a cold thisel must be used for this, the rivers should be placed on an anvit or other metal support. Then drive the old parts out with a hammer and punch.

4. Place the hame clap of the tug D (shown in the small illustration) and the holdback plate E on the new hame staple F, and drive the maple in place

I Clamp the bent part of the staple fumly in the vise with the hame above the vise as shown at G Then place washers on the staple ends and rivet firmly in place, If the hame has iron on both edges, the washers are not used. If the hars of the stapse are lunger than necessary they should be cut to project only also at 16 in, before riveting,

To repair he bottom and of a hame If the hame aron K is still servicehe but the loop is worn, the old loop I, if cast may be removed with a cold chiselghe hammer and a bottom hame repair loop H inserted

2 If the har e ron is worn, place the hame in the yese and cut the hame iron in his new the rise with a back saw

J Remove the old rivet A good way to do this is so center sunch the head of the rivet and deal off the heat with a fain 1 an drel. I, may then be removed with a punch and hammer,

4. If the new loop I is cast, it should he placed on the repair clip I before the clip is praced on the harme. If a screw type be core loop II is used it may be attached a er he repair el p is rive es in place

5 Place the new loop on the repair clip and the clip on the end of the hame under the hame from K, If it were placed out spie of the hame from the end would catch the hand when the hame is drawn in place on the col ar

6. Place the rivet through the hole in he hame from and the report clip, insertng it from the convex edge of the hame With the head of the rivet rest air on an navil vise hw or other sold surface fivet recurely in place.

7. File the sawed end of the home from smooth,

In a second article scheduled for early publication, Mr. Rockl will give histractuing for repairing traces and tings

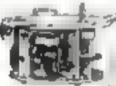
TIGHTENING HINGE PINS

HINGE pins that are so loose that they un be judier out easily are a nuisance especially in a home where there are children with prying fragers. To prevent the removal and possible loss of the prosclean the top of the hinge and the head of the pin, place a drop of shellar on each, repeace the pin, and lock the door until the shellac has set. This will hold the om securely.-ELTON STERRETT



"Our Readers Soy" is getting to be one of the must divecting and interesting fretures in the majazine. If you have not written in to the Editor of "Our Readers Say" why not breek into print with some idea that you are interested in. Your letter will be welcome.





G.E.PHONOGARPH MOTOR

Synchronous 110 Vall. 69 Cycle 80 R. F. M. Motor

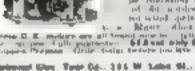
be bestalled in \$1,000 Value of the soldier best best by the 1 and the soldier best by the soldier by

Total Co., 286 W Labo St., Bupt, 263 Chicago



Write for Catalog No. 214

CHICAGO GEAR WORKS





Reduced prices - Bory Terms 1 AMERICAN FARM MACHINE CO. 1072 33rd Ave. S. E.

Minneapoles, Minn.





bandwhee and step man draw in cyllett. Lee page 54 tol.

Special Offers Board B. 907 or Manter Boards Hand a PRIE may 6 a 7 d all turn to a grinding a 5 m and 6 d band pounded on separate mancrets. Wester or bunkles

TUICONSIN ASSASIVE COMPANY Statist A

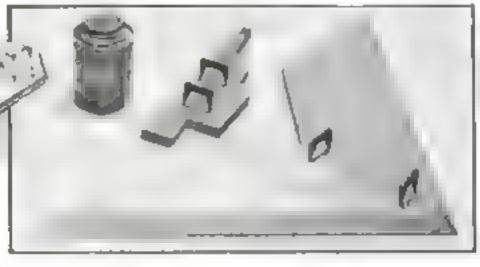
ODD-SHAPED PARTS CLAMPED WITH PINCH DOGS

How plack dogs the are applied to class draw the parts of a frame together the call like ed the

Out-shaped, angular, or even plain rectangular pieces of wood often can be clamped or held together for gluing, marking, or fitting much quicker and in many cases more easily with the aid of what are called "punch dogs."

These handy little clamps are shaped like a very heavy staple with the inner edges of the legs slightly tapered. When the sharp points are driven into the (wo

pieces of wood to be joined, the taper draws the parts together. The clamps are sold by the larger bardware stores, as they are much used by pattern maken and molders; and, of course, they can be made by anyone who is willing to take the time to do so. The indentations left by the clamps, if on the face or finished side, may be filled with a plastic wood composition.—W H. McCullough





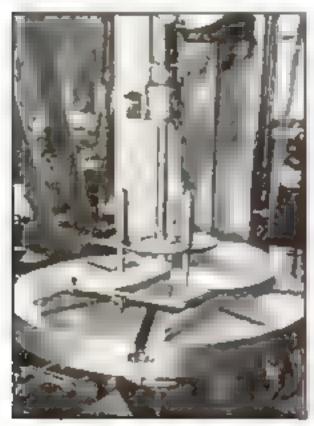
Puch dugs or the type commonly used by partern makers and other machanics

PROPELLER KEYWAY CUT ON DRILL PRESS

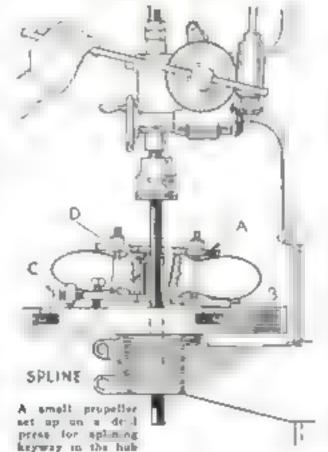
IN THE accompanying Blustrations is shown a very simple method of equipping a common drul press so as to cut or spline a keyway in small propellers.

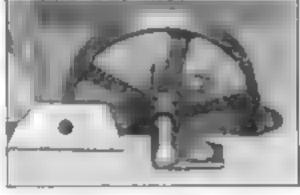
The plate A is round and has three holes drilled in it 120 deg, apart to receive the three holts or threaded ruds. The lower plate B, to which the botts are instened is square. Two pieces, set parallel on either side of the square plate and held to the drill table by dowel pins, act as guides for the square plate when the feed screw C is turned.

The tool D is carried up and down by the drill press feed lever, and with each down stroke of the tool the screw C is given a part of a turn. The plate B can be raised or lowered to conform to the angle of the propeller hab that is being machined.—MAURICE R. Snow



The propeller is clemped between two plates, and a serrer is used to feed the whole set-up forward at each struke of the catting tool





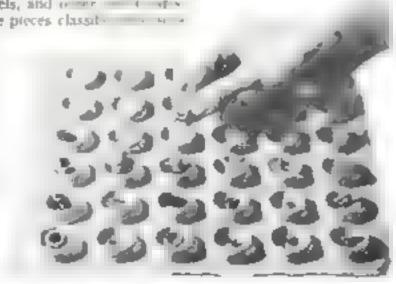
HINGES PROVIDE AXLES

When it is necessary to fasten small wheels or pulleys to the woodwork of homemade toys, moders, and other devices, it is often a problem to find suitable axies and supports for them. As a rule, however, a good mounting can be made from part of either an old butt lange or a Thinge. Cut it away with a backsaw as shown in the photograph above. The pin can be driven out, shortened if necessary to suit, and again riveted in place. If the hole in the wheel is too small, it can usually be redrilled without difficulty to suit the hinge pin.—F W B

EGG PACKING SERVES AS SORTING TRAY

WHILE taking apart a clock, model, or men to make many composed of acrews, wheels, and or men to discovery you will find it best to keep the preces classification in the

arated so that you can find them easily at the time you have to reassemble the device. A convenient way to do this is to use one of the fiber sheets made for separating eggs when packed in a crate. Such a sheet contains numerous small, cuplike depressions, each of which will hold several small parts. Identifying names, numbers, or marks may be written on the fiber to prevent any confusion—Lavis Walters



Electric Telegraph Set 15c



New Magazine



on the building of Authentic Models

CLEVELAND & Practical Habbies

p. being breather the methods of the probable of the probable

Fig. 1. The parties of the parties o

Cleveland Medel & Supery Co., lett., to work the tr.



earthwittle EZ1 of enodes to he true blue of Drake a contents singuing for the the contents singuing for the land and if Page 11 if Page 12 is the content of the land and the

ROY HANCOCK

\$23 5. Douglas Ave.

Portsmouth, Va.

tions of special compute at feath programmed appears may free at art are to the second at the second AMERICAN PROPERTY AND ASSESSMENT AND ASSESSMENT AND ASSESSMENT AND ASSESSMENT AND ASSESSMENT AND ASSESSMENT AS E J JORGENSEN

BEATTLE, WAL



\$200 WOOD

1978 MARKETHE BLOG.

TURNING LATER
You man prop tanglowing to large
house. Spile Period II. State
where, prin who up II. State
for a firm a fact regular days
for a firm a fact regular
for a firm a fact regular
for a firm a firm a firm a firm a firm
for a firm a firm a firm a firm a firm
for a firm a firm a firm a firm a firm a firm
for a firm a f should be more a frequency to the particular of the first manufactural description of the first minute small few long street, the first manufactural description of the control of the con



(Continued from page 81)

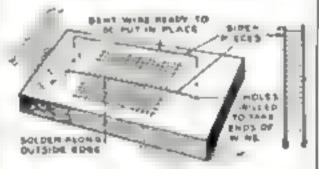
is decided fad these days for colored sails, and your boat can be made distinctive by dyeing the sails in some attractive shade of red, blue, orange, or other color A waterproof sail cover is inexpensive, and money well spent if you would preserve the sails.

The stays may be either 1 4-in, sash cord or any twisted wire that is not too stiff yet is strong enough to withstand a load of about 1 200 lb. The mast end of the stays is made in a loop to go around the mast and held in place on the mast by wooden shoulder cleats screwed to the mast. The lower ends are served over a thimble through 3 8-in, eyebolts. The ends are made fast simply by wrapping the stay ends with about 22-gage copper wire and then hard-soldering the lap. This makes a strong, neat Job. The slack in the stays is taken up by tightening the nuts on the eyebolts through the runner plank

The other details of construction—mast step gooseneck, stem piece, and 18b-sheet traveler-are so easily made from the drawings that they need no comment bere. With the aid of the plans you will have no difficulty in rugging the ice boat.

It is a convenience to have a boat snap spliced into the Jib halyard end for quick sitachment of the lib, and also a shap at the foot of the jtb to secure the pb to the forestay eyebolt. It is customary to take the jib off entirely and furl it with the mainsail so that it is also protected by the sail cover. These snaps are additional to the bardware listed in the bill of materials last month.

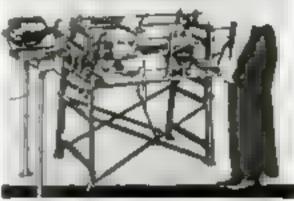
SHIP MODEL LADDERS MADE FROM WIRE



IP MAKING the small ladders for the POPULAR SCIENCE MONTHLY destroyer model is a tax on your patience, you will appreciate this easy method: First cut small strips of bronze or copper insect screening (sixteen meshes to the inch) as wide as the ladders are to be high. Then use sharp-pointed scissors to cut out five or six wires from the center of the strips as shown. Lay one of these pieces flat on a sheet of asbesion board or some other suitable surface, tacking it in place if desired. Cut wires of the desired length for the sidepieces, bend the ends as indicated, and drive the latter into holes previously drilled in the board. Solder carefully along the outside edges of each sidepiece. Then sever the strands of wire with a knife so that finished ladder can be lifted off the board. Trim away the excess wire from the sides and cut off the bent ends of the sidepieces.—C. S.



SHARPEN LAWNMOWERS AND EARN COOD



BUILD YOUR OWN PROFITABLE, PERMANENT BUSINESS

Anyone who will earnestly go into the lawnmower sharpening business can make from >10 to 550 per week their first season, Many men have made more than this in their space time alone. W. C. Fink, Pittsburgh, Pa., writer I turned out 604 jobs and my standare price is and always has been \$2.00 per " wer." Niles C. Rate, Rochester, N. Y. weiter. "I have to date sharpened 785 mowers at \$1.00 each "Wm Seduckl Watervliet, N Y writes The Ideal is a wonder, no one can do a bad job on It "

THE IDEAL SHARPEHING PRIN-CIPLE IS USED BY ALL LAWN-**MOWER MANUFACTURERS**

The Ideal Sharpener is a model of simplicity. It grands the blades of a lawnmower with surpribut speed and occuracy w bout taking the mewers apart. It employs the same method of sharpening as used by all leading lawnmower binning were 2 (teen monutes) work will put the average mower in perfect condition and you get from \$1.00 to \$1.50 per mower

HO TRAINING NECESSARY

No stammer is required. Just attack the Ideal to a light socket and start to sharpen. Hundreds of that assumences are in your vicinity fight now, was ng to be sharpened.

NOW IS THE TIME TO START

Solic t lawnmover sharpening business sow. Get stated ea for in this b ness he early bird ratches the worm." Write (enn VII 278 M. 7 88 THE PATE ROOT-HEATH COMPANY 337-375 Bell St., Plymouth, Chic

DESCRIPTION OF THE PARTY OF THE

Name			_		
Address					
City.		al an in			
				address)	

A. J. H. Hotel Products Co., Hapt. 2,

"A Baby Can Make It A GIANT Can't Break It"

CAS

THESE are the exact words of one of the thousands of enthusiastic CASCO users who have discovered that there is a difference in glues.

CASCO Waterproof GLUE be-

cause of its exclusive easy-mixing formula, mixes quickly in cold water, forming a amouth, creamy, easy-spreading liquid glue, absolutely free from lumps. You cannot go wrong with CASCO—equal parts of powder and cold water from the tap make a liquid glue of just the right consistency.

FREE! NO GLUING GUIDE

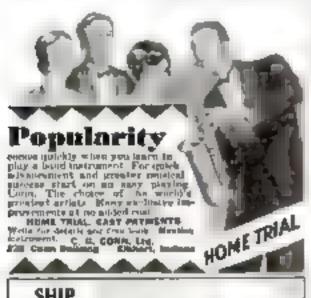
Just for your name on a ponny port card, mail to the address below, and we will send you, absolutely free, a cupy of the CASCO Grang Guide-50 pages—75 illustrations—contacting bundreds of maney-towing and money-making ideas nobuilding, repairing and mending things quickly, sassly and presentally,



CASCO Waterproof GLUB is sold by Hardware. Paint and Building Supply Design.
Tetal package 10c; K lb. can 40c; 1 lb. can
65c, also 5 lb. 6 to lb. montary-proof bugs.

CASCO is Economical ... 1 pound of CASCO makes 15 quarts of Liquid Gine!

THE CASEIN MFG. CO. OF AMERICA, INC.



SHIP MODELS

TEXA

The quick and mass read in this sectioning is in and one of oil dependent should decorate high terms part on a recommendation of the species Section part of the species Section of Section 1 in the species Section 1 in the species Section 1 in Section 1 in the s

Madel Ship Supply Co., Dept. W. Missolu, N. Y.

Build Your Own Electric Grandfather's Clock

things Accounts and Placet Characters (1990.)

Ent. Installment payments. Clock can be ensign and quickly assembled. We adjust a partial No payment the networks to a partial No payment to the networks to a payment. They pay payment to a payment to the payment the payment the payment the payment the payment.

HARTFORD CLOCK CO. 191 Co. 201 Fire

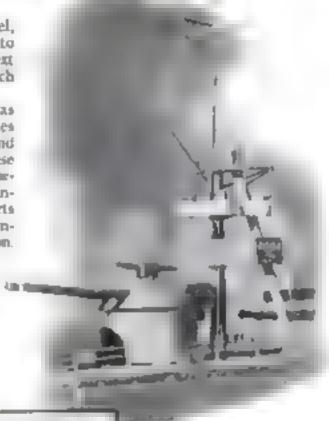
Adding the Armament to Our Model of the Battleship TEXAS

By Capt. E. Armitage McCann

IN BUILDING our battleship model, the U. S. S. Texes, we now come to the remaining mast. It is the next erection aft, omitting the armament, which we shall take up a little later

The construction up to this point has been covered in three previous articles PSM Nov '32, p. 67, Dec., p. 71, and Jan '3 p. 68) In the second of these (Dec. pp. 72 and 73) the complete drawings of the side view, deck plan, and principal details were given with all the parts indicated by numbers. These are the numbers used in the following description.

The most tripod is like the foremast, but not so high. The legs spread at the same angles and are each 3, 16 in. in diameter. The control bouse (46) is made as shown in the drawings just mentioned. It must be carefully bored for the legs. The four-leaf clover above (47) for hokkut the searchlights is made



Mast and the No. 4 turns with tange finder on top

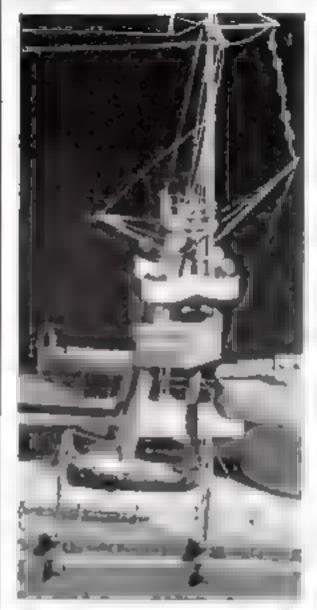
Lke the flying bridges, of 24-gage sheet brass. The weather screen is a strip soldered on.

The lookout-platform above (48 . is circular, but with a high acreen at the fore edge. This I also made of brass, bending the screen up. Abaft ft has two-ball stanch one midered on, with the usual wires. running through them. Exlending from this at the sides are wires for the backstays (40). These are made in one piece and apldeted under the forward and after rims of platform 48. At the after edge ss a scant ja-in, hole for the signal mast. This platform is nailed onto the top of the tripod struts,

The mast is barely 3/1 in, in diameter and tapers to about half that At the position shown is a yard (50B). This is so small that I made it of brass rod, binding it in position with wire. From the same position a short arm extends aft, horizontally, This I also bound



A bow view of the model. This shows the first two turrets, one mounted on a low barbette, the other on a high barbette



Navy whelebout and davice and a clear aide years of the mast described in thes ortical

on with wire through a hole in the end From above come the yard lifts, passing first to the yardarms and then to the end of the horizontal arm where they are fastened with solver,

The most ships through the hele in platform 48 down to the second platform It can be fixed with a gail, If of wood However, as the mast is quite slender and akely to be accidentally knocked if the model is a working one, it is better to make it of brass rod, for which the process will be substantially the same

From halfway between the platforms extends the flag gaff, made of brass wire At the yard-lift position I passed the hight of a thin wire, twisted the parts together, and carried them over the end of the borisontal arm, fastening them with solder. Then I threaded four glass beads over both parts, opening the two wires to hold the beads at equal intervals. The hight was now soldered to the gall, and from there the two separate ends of the ware were run back on each side to the wires for the backstays (49).

From the yard position this wires no through the ends of 40 to staples in the struts, From a point on the mast halfway between the yard position and platform 48, similar wires go to the ends of 49 Still another wire runs from the same halfway point to a heavier wire which eatends from the fore edge of the platform Two supporting wires are soldered at an angle to this horizontal wire and are driven nto the after struts. All the thin wires mentioned have six beads spaced in pairs at intervals along them.

In stepping the main triped, you must be sure (Continued on page 93)



MUSIC - the Surest Path to Friends ... so easy to learn this short-cut way

No loozer need you easy people who play the porter who make friends imme as ly wherever her on New th. men's per exted have deter common to the property of the common to the com

Note that the state of the stat per cattler in groups of course the strength of course the strength of the str

Easy As A-B-C

EARN TO PLAY LEARN TO PLAY BY NOTE

Gu 1AP Organ Tream Sauje Miletin derrahe Ukuli le Phone or Guilge Phone Assertion Or Any Other Instrument and so to the second and the party.

that he for the sales of the sa the result of the state of the second of the

B Benetant Hing. New York City

b rid was man pro string for se thought on Visio on M. S. G. on S. Desir store to a distribution of the form of the second of th

Same

product they are they are the of the control of the

A. J. PHINES 1860-2 ligweit fes . Goget fich. Hint

If you like Popular Science Munitiry why not pass the word along to your friends. When an article in this magazine strikes you as being unusually good, tell your friends to get a copy at the newstand, and read it.

New 1933 "Boice-Crane" TOOLS

ONCE MORE Boice-Crane leads the way with here features, now ideas, now method and new process here before have as h practice dependable and accounted as here avails of rate the money Some Phase Crane solity samewith mansh pringle S. W. LOW (M. S.

DRASTIC PRICE REDUCTIONS 1" Ball Bearing Lathe nose only 125 h Ball Bearing Jointer was 1 5 now 155. Thing Arbor Saw was 35750, mw 1 883 Larger Top Titing Arbor Saw was 155 now 14, 65 Other machines reduced arrord as y Write for new Price Correction Should be seen to the control of the second sec

July for job, the Borre-Come Tilling Arbot Saw was out over tilling table prior revery time. Bull-tip 27(0) describes and dispersion the advantages of LATEST

Artes Sew Blens See bulleten before buying ARBOR MAK age mark

TILTING ARBOR SAW?

e and newest pull type saws The best and navery pull type saws me the (thing artest procepte. Why?) Saws costing \$ 000 and rame have siting artest. Why? Is the perscapit with superare to the triung salar? In the Bonze-Caner Taking and Lowesting Arbert Saw miles many accurate, and more remained than a Triung Table Saw? Those and stony other persuant are approved in Bulletin # 200. It's FREE, Write in a

A COMPLETE LINE. Saw taking fainting—Later Band Sawafig Sawar Sanden Stapers. If you draft with a hardware or machinery
dealer, main upon using the new Bang-Crane Models before you buy ANI
machines. If you have old machines and want to trade for new up-to-themaste models, write for liberal trade is allowately.

Sold on early payments—satulation, generation.

NEW LOW PRICES

NEW JIG SAW 24"x5"

Special table puzzle sawing.

Adjustable tension h quick relense. Sliding head long or shor, blades. Drip proof upper

punger beerings. Table of des back to make blade charging easy Table and a disk black may be termed 90° to opera o her a hand now

NEW 10* JIG SAW Standy east trake frame. Spring for-zion, Tokes franch blades. Wandedal for passile among.

FREE CATALOGUE! W. & J. BOICE, TOLEDO, O. Please send me-Dept. P3-21

Catalogue with he Saw Bulletia.

Saw Bulleta #700 Trlls why a
Tilting After Saw a best loc my work.

Sheet of new low proces for catalogue F

secrets of Success, STORIES THAT WILL HELP YOU GET AHE \Delta

How you can get into Broadcasting



FLOVE ANTIVE in Figure remarks while dispose and the common to the place of the common to the common

Floyd Cabbune School of Branchasting, post (4)6 \$0 N W Dogs 18th Washington, D C 35 h of diga in cent by a sec- by 1 w b and 5 of Place of S side about a sec- by 1 w b and 5 of Place of S side about a sec-by) presentation of 5 of both both a sec-

Same

Please Print of Watte Surge plain

Adaption

Sta P

The great to an atopt to to ago be a tory or to be published for relating men have in Charmes in close big-perfect. In equip 2 works. Then they get behind you be assured for one by going to the assured for your T. Can cake adjacentage of their remarking merhod of bearing by yestern the contract of the product of the pro



I WILL FIMANCE YOUR TRAINING

to at more flet peut The nature paying the for year is using a full from months. It is not take to full two months in complete year payments. If you we write to the a search of the latest payments of the latest paying the same latest of this was actional to be been actionally with F 1250 and R to be many the beautiful to be because only the trainall about C YNF and boor man without head study of C President

FOR FULL DETAILS!

Mr. H. D. Lewis, President. Dept. 23-71-300 G. Paulina Bt. Chiespo. III. T-II me her very will feneral my training at COTNS on the BIG FREE Conserved been up that The TRUTT

MAME ADDITION

STATE

ELECTRICAL ENGINEERING

A Direction, comprehens, or more for men of liberal me, complete pa one per Markemal-les, complete pa disconstruction or mail of me lest checkens marks mery himsen buildings. If years' descential experience, Caragon on majorat.

BLISS ELECTRICAL SCHOOL

DEPRESSION PUT HIM ON ROAD TO SUCCESS



HAVE not had a job for twentytwo months That may be a lunny way to start a Success Story, but it's the best way in my case, because it was this long period of unemployment that made me take stock of my as-

sets and set myself on the right road Three months ago my savings had

reached a low point. After careful conasteration I risked my last savings to buy the necessary machines and supplies, and began the manufacture of jixsaw puzzles in the kuchen workshop of my two-room "apartment."

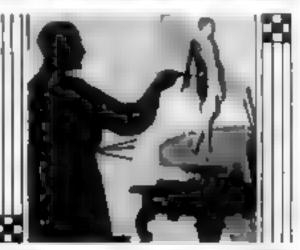
My first customer was a neighbor who had been renting picture puzzles from a ibrary for several months. After cumpleting ten puzzles I interviewed the proprietor at a busy little abrary. This lady agreed to try them out on a 50-50 rentas basis

When several more puzzles had been completed I called upon another lady who operates a string of libraries and renta puzzles from three of them. She was immediately interested in my product and ordered six 350-piece puzzles from me. She also asked me to make pieces to replace those which had become lost in ordet that the puzzles in ght again become money carners. Her next order was for four, larger sized puzzles.

IN THE meantime I was renting new puzzles, as they were finished, to my one rustomer and then placing them in the rent string of the first library, At present I have 22 puzzles in this string and they are earning several dollars per week for me. I have more orders from the other library and have found another customer for the replacement pieces. I introduced "Hidden Name" greeting cards to the buyer of a large book and stationery store and five orders were taken before the end of October I have arranged to make 100 piece puzzles from photographs for a portrait photographer in a large department store

Now I cannot bandle the volume of work by myself. I have been forced to expand, and have tented space in the back end of a cleaning establishment. I have plenty of room for my workshop, and am allowed a front window in which to advertise the puzzle renting service I am starting.

Two friends who have been hard hit by the depression have decided to take a chance with me. We have rented housekeeping rooms (Continued on page 91)



Through art braining you may find the way to a large thousand. Many successful students of the Fuderal School of Eliestrating are pay carning from \$2500 to \$6000 a year and many are making seen above. Through the Fuderal Course may then fifty famous extists—making hig manay themselves—give you their drawing tecrots. In your spare time at home you may correct, In your spare time at home you may correct, their methods of Illustra my Cartooning Lettering Poster Bengang, Window Card Illustrating also.

limitent of min. Learn to "mint" your art talent through Fod-eral Training Food as your arms, ago, compe-ion and address and we will send our Book, A Boad to Digger Things and Vecational Art Topt

without obligation. FEDERAL SCHOOL of ILLUSTRATING

1143 Federal Schools Building Minusapolis, a a Minneson



and Design

Good per alcate work.

Assistement a best paid
per year in Lagrangian in best paid
formating it nell at house utgay. Astating,
large of college et ardiert in touter actual prace
for in denting and design. The new set is 100
Well-Paid trades buch, U.S. Navy, etc.

Positions School characted 35 years and an ing at most made in the long process for the position of the total process of the position of the total process of the position of the position of the total process of the position of the pos

American School, Bept. B-340 Brusel Are. at 66th St., Whitege

How To Secure A

Government Posit

With an erry phospil or hope imposite that it increases the supposite that it is not the supposite that the supposite t

to be the control of the property of the part of the p resuper for a new renty likelity,

TRI-STATE COLLEGE OFGREE IN 1 YEARS

R.S. cheered in U.St. Bise-tical Mechanical Chemical. Account to Latinic my to 2 are Those who much it at section man patter up with he age count, tolloop low with the by count frage all over the winted Write for citying.

Tou 523 College Sex., Angels, Ind.

Secrets of Success

DEPRESSION PUT HIM ON ROAD TO SUCCESS

Continued from page 9()

nearby. One partner will attend to the cooking, shopping, bookkeeping and make deliveries and run errands. Two will do the actual manufac uring

I have invested less than \$200, and there is sufficient stock on hand to manufacture several hundred puzzles, Rent is paid a month ahead. I have taken in \$60. in cash and there are orders enough to keep . us busy for the next three months

I am not yet rich. It will be a problem to exist until the business becomes self-supporting. But prospects are bright Three people are removed from the ranks of the unemployed. We are using plywood, paper boxes, sheet pictures, saws and machinery; putting money in cir-

The project has the earmarks of modest success.-W. L. F., Son Francisco,

HE LEFT DITCH DIGGING TO BE A WATCHMAKER



FTER I finished public school I was forced to look for a jub. For three years I worked as a news hutcher trains, but I knew this was the wrong place for me The longer I worked the further away I traveled from the

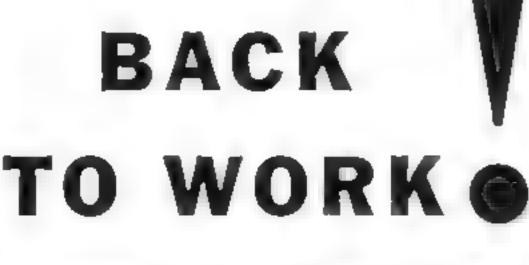
road to success.

Actually I wasn't quite sure of just what I wanted Somehow I drifted into radroading, working with a construction gang on a line out of St. Louis. I put in four years of back-breaking labor on that job, and finally it became so irksome and hopeless that I decided there must surely be something more pleasant in life for me.

I nawaya enjoyed tinkering around with delicate mechanisms, and the thought struck me that perhaps I could make good as a jeweler Being fotherless, I consulted my older brother. He discouraged the greatly, saying that any money spent in learning a trade like that would probably be thrown away. The occupations he suggested did not appeal to me

Though depressed by his words, I found the determination to become a leweser growing stronger within me every day I was married and living in Atlanta Georgia, at the time. I applied to several jewelers in that city for a position as apprentice, so that I might learn the trade All I did learn was that no one wanted to be bothered training a new man. Refusing to be discouraged, I decided to get that training by myself. (Cantinued on page 92)

So you're going



THAT'S FINE! And more good news is that improved business conditions are sending thousands of other men back to their old jobs or to new jobs.

But don't let your enthusiasm dim the facts. Business today, and from now on, has a new standard of service. It is a standard of efficiency-of training-and to ignore it is inviting another long stretch of unemployment.

For your own sake, man, for your family's sake, do not firt with this disaster!

Especially foolish when you can acquire so easily the training you must have ... when you can make yourself more valuable on your job by devoting a small portion

of your spare time to study. In years past millions of men have come to International Correspondence Schools for this training. Today, with its unusual conditions, is bringing many of these men back for additional training. to meet and solve the problems of a new day-and many thousands who have decided to face the facts and assure their own futures. Will you face the facts? Do you want to assure your future? Then this coupon is a challenge to you! Why not mark and mail it-right now? If desired, you can arrange to complete the course of your choice through easy monthly payments. Write for full information today.

#NTERMATIONAL = CORRESPONDENCE = SCHOOLS

"The Universal University" BOX 7635-G, SCRANTON, PENNA * Without cost or obligation, please send one a copy of your booklet, "Who Wine and Why," * and full particulars about he subject became which I have making X

T Ambiber Apphilical
And secural Desirem
Parelline E. marche
Parelline E. marche
Poster and Journal
Source of all profession
Source of all profession
Every rec Wing
Electrical Engineer
Electrical Engineer

E ie la W Est Electric and Cas-les-une St o Receptors Triegraph Engineer

Other Management Office Manageree's in est a H maxement To come Management Ye owner Mariate on Yearth Management Attrouved of

See 1

Cth

TECHNICAL AND INDUSTR AL COURSES Trite is as Work

The a way Exchange

I down and Dustman

I've armshire

I've armshire

I've teg Transition The real Parliment | Parent Method College | Parent Nother |
The real Parliment | Parent Nother |
The remains | Parent Nother |
The remains | Parent Nother |
The remains | Parent Nother Nothe 1 Thomong

C P Arrountable Feedback Work
Feedback
Thereback La dell'ettarine

L P. D' willow

BUSINESS TRAINING COUNSES. The Lives Consequence Serge
The corting Mont Catch
Street
The corting Reset Tripling
County to disquence that
County to disquence that
County to disquence that
County to disquence that

Chees of the Engineer of Engin Worken Meanutocturing
Worken Meanutocturing
As a utilize
I he he to think of
making Paraphag
Bailin
Matine Engineer

Highway Engineering

Balling Ma West nde School wat nein the School School to offene Preparating illustrations tarison ma Lumber Dealer

Alleron. 400 Ptate

Occupation. If you receip in Canada, and that coupen to the Indexes; and Cartesposociate behavior Canadists. 2 or 1 d. Montreal, Canada

One Year From Today

This may be the most important year in your life! Your whole future is apt to depend on how life! Your whole future is apt to depend on how you take advantage of present busine a changes. For moth has maybe years—a impunies who be able to cause whoshever too; want out of the millions now unemployed or disamisted with their work and pay

Naturally they will pick the men with most ability. You should make yourself more valuable now but only to protect who you have but to win potion one, to make up salary cuts it is being done by OTHERS - It can be done by YOU

YES-Pay-raises-TODAY!

Hundreds of Labidbotts and men and women are They are beating the depress a and insuring the future Ask us for our new five booklet. 100 Pay Ranger Tomy showing what they are doing and what your on do.

Ask us are) so send you full details about our new spare-tille training and to explicit how to preputa yout to meet today a demands and opportunities also ploud our salety increasing dian. If you rear, are negreest, you glood investigate at on a. Check your subject below, write your name and address, and made

LASALLE EXTENSION UNIVERSITY

Dopt. 283-ft

Sand the left your saw remember, 1930 Pay Rate to slave and do not of that training painting to business belief checkeds The ther A continuous y libertones to the part Bunkherepung Lagrant Character State Continuous Character Continuous Character Continuous Character C. F. A. Couching D. D. C. Accept States

Management

C. Madeco Salvementship

C. Industry Salvementship

C. Modeco Salvementship

Eduction Spunking

- 10 - 10

Sand for

PREE BOOK

Private Private

LEARN in CALIFORNIA



BUT-You Rhest Se Trained

These are quicking to the The years of the dark selection of The grant of receipt to the dark selection of the part of the selection of the se

Secretal New Course-Radio Brandonst Technician

and hard he for disco-PUBLISHED TO SERVICE Receipt oppose given in instructe debusely.

The little tests | With a selected our selected our





priore a and a rolly of with work The IRVING VANCE COMPANY Let 115 Hart Sudding, Toronto, Can

Secrets of Success

HE LEFT DITCH DIGGING TO BE A WATCHMAKER

(Continued from page 91)

Searching the advertising sections of magazines appealing to mechanically inchined men. I found that a course in watchmaking and repairing was offered by a well-known correspondence school at a comparatively low cost. Here was a chance to learn while bolding my own ub. My wife was dead set against the dea, saying that it was just a notion of mine and that I would probably drop out before finishing the course, and so lose everything

But my confidence was stronger than her arguments and I went ahead with my plans. I look back on the months that came afterward as a period when I worked harder than ever before or since. Day after day. I labored at digging ditches. Night after pight, long after the family was asleen. I sat up in a small back room and studied. Luckily, I was so greatly tascinated that I never thought of it as work. I finished the course in 1940, when he depression statted, and so, when I old the boss of my gang I was quitting

he thought [was crazy

We moved back to my home town and what little capital was left went into the watchmaking business. Two years have possed and I m still at it; not making a fortune, but managing to make a living and to keep ahead of expenses This can't be called a great financial success, but it is a success in so far as I am bappy at my present work, keeping my head above water-and looking for better days when things become more normal. I'd have no such outlook if I were still digging ditches .- C. L. B., Camden. Tenn

Cash Prizes

THIS department will give \$5.00 for every true success story submitted by readers of Popular Science Monthly, and which is accepted for printing in this magazine.

Manuscripts will be judged on the individual merits of the case and circumstances involved. Only atories in which the author's success, or that of some one known to the author, has been gamed by some method of educational guidance, fitness for the job, or application to the work will be considered, We are not looking for the "get-rich-

quick" type of story.

Manuscripts must be confined to 500 words or less. They must be true and, if accepted, authors must be prepared to give us signed statements to the effect that they are true. Manuscripts submitted and printed become the property of this magazine, and we are not responsible for the return of rejected stories unless postage is provided for this purpose, Address con-tributions to Success Story Department, Popular Science Monthly, 351 4th Avenue, New York City.



in Astornee. Em world's finatust growing andrestry.

LEARN AT LINCOLN the world's best known avanton action. Here we give you complete thereigh training that wint high recognition for our produces throughout the world, Both ground and flying action! Covergence Approved Covergence Licensed Instructors. Uncaching apparentlists both to S. and foreign countries. Big may opportunities both to S. and foreign countries. Supercetally in Contral and South America We have representatives and attended in S. located countries. As well as students in every atter in the Union. Aviation courses tought in either Spanish or English. Court to Lincoln gue be need of a successful carrier in aviation.

Lincoln Airplane Friying School Lincoln Airplane Friying School





We Carrie behand of Muchanical Dan book Arctics Ougt 5 857

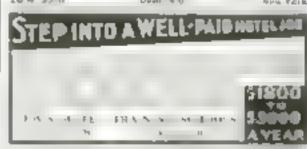
Mysterious Power of Pelmanism

Let u send man freb eept of Beleen de hing Teaming "An in a stack with explain to do not a green of Bendul had a a a a a bendule from all all people I will be send on the explain to the anneal of the send of the same of the first of the send of the same of the send of t

THE PELMAN INSTITUTE OF AMERICA 371 MOSTHAVENUE, DEPT STE NEW ROCHELLE, M.Y.



The transport of the property of the property



New York Established Electrical Schoo tak for free booklet 40 West 17th St., N. Y. C

BATTLESHIP TEXAS

(Continued from page 89)

that the distance along the deck between the after struts and the fiddley is not less than 4.3/16 m. or the guns will not swing

The emergency boats are kept in davits at the afterdeck. The davits are round. tapered to the end, and about 11/2 in. high They are set into sockets on the armor plate and are supported by brackets from the drok as shown in detail 65. The sockets are pieces of tube soldered to plates the latter being driked as shown for nais The brackets, which extend some way out to keep the davits vertical, are brass plates drailed for nails. The boats are payy whaleboats. They should have a few pars in each and be hung with two double brocks as small as you can make them. All are gray except the onra. They are usually kept swung out, but they are less akely to be demaged if swung in,

THE seaplane is shown in detail 13. The (uselage is cut from a piece of 1/4m, dowel, the wines from 1/16-in, plywood ther board or brass. Holes are drafed through both for the struty, but nating them to the fuscinge is what really holds them The propeller is cut from wood or bross and fastened with a pin. Four struts (brass wire) come from the fuselage to hold the pontoon, Side pontoons are omitted. The tail is brass or cardboard haded on, and the rudder is the same. The ship's name abouid be lettered on the sides, and the tail painted red, white, and blue, the red being forward. The plane rests on a carriage running on the catapult. and the entapult is set on a round turntable on the third turret, as shown,

The full armament of the Texas consists of

Ten 14-in. 45-cal guns in turrets, mark I; twelve 5-in. 51-cal, rapid fire guns, mark VII; six 3 in anti-a-reraft guns, mark III; three 3-pounder saluting guns, 50-cal, (length 90 in); two 1-pounder seminationatic guns (length 30 in.); two 3-in. 23 5-cal, landing guns.

The "ratiber" of a gun is the diameter of the bore at the muzzie. Thus a 14-in, gun will have a bore of 14 in. The designation "45 caliber" denotes that a gun is 45 times its carber in length, or in the case of a 44-in, gun 52 ft. 6 in., to which is added the breech. The "mark" is the degree of modification from the original mark I."

Ot R 14-m, guns will be 3½ m, long by 3/16 in. (full) diameter at the breech, with 2¼ in, projecting from the turrets. All ten of them are mounted two to a turret.

The guns can be cut or turned from wood or brass. Note that the muzzles have only a slight flare (see 37).

The turrets (9) should be cut to the shape shown. The holes for the guns must be carefully made halfway up the turrets so that the guns will be horizontal and parallel. Any divergence will look had, and all the guns must project the same amount.

These turrets rest on the barbettes three of which (7) are low, and two (8) considerably higher The barbettes should be turned or (Continued on page 95)

I will train you at home to fill a BIG PAY

Free Book
Tells How
Mail Coupon!

If you are diseas shed with your present tob if you are running a state one into mith little or no prospect of any his or is had a sharely pay excellipes—city the confect. A fact or his FRIE book on the opportunities in Access Read box or his post can bear at home in resp. and time to the Bade I a seet who is of the my graduates have been getting that, a do such rest futures.

Many Radio Exports Make 650 to 6100 a Week

In alrest ten years the Radio Indian to has given from \$7,000,000 to hundreds of methods of dollars. For \$6,000 join have been created by the growth, and thousands to to a she created by the continued development. Many ten and plang men is the fact for in the last of the sound of the test of the sound of the fact of the sound of the

Got Roody New for Jobs Like These

Freedom in a state of the engineers of the south of the material and part of the south of the so

Many Make \$5, \$20, \$25 a Week Extra in Spare Time, Almost at Once

The day a greefall with me I send you material which you should not not a set of a set of men or in a set of the not of t

Trievision, Short Wave, Telking Novice. Money-Sack Agreement Included

Append training in Tall to Merto To an part Herry Time in part of the State Rafile of motion to a section.

If you like the training to your like the training to the training to the part of the training to the training to the training product that the training product to the training training to the training training to the training training to the training train

At-Page Sout of Information FREE

The year Peop trains
It a free to all training
of the retroit Phane prof.
I amade ever a start no.
In all the whole Phane
away puts and what the
away puts are what the
tester when where his
tester when where his
tester when it are doing
an making Plane and
what Martin after put to these his

J. 2. SMITTH, Proc. Metional Hadio Institute

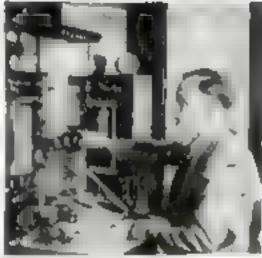
Bapt. 3EFS Washington, B. C.

THE FAMOUS COURSE THAT PAYS FOR ITSELF

acce sertre in 6

to handron over my rest

Will HOGHL & & c.



Radio Job

SPECIAL Radio Equipment for Broad Practical Experience Given Without Extra Charge

The state of the s

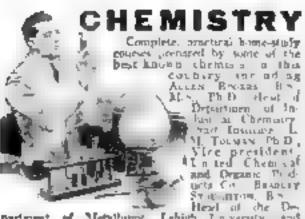
With M. R. L'equipment you learn to build and harsunker understand art testing equipment art are N. R. Les apares in our spare and see the build for extra proper



3 E SMITH, President National Radio Institute, Bept. 3873 Washington, D. C.

There 314 Her the Witchest obligating his settle free book about open tilber at 2 of other thanks opportunities and lever I rule train the them, at booms.

them at 1	HOME IL.					
MAME.		-+=: -:				
APRIME.	436.	 71	41 1			
CITE		 ,aTa	TE	,	no n ndo	



partment of Metallurey, Lehigh Inversity and Overs L. Survey Ph.D. Professes of Applied Chemistry In crisity of Pennsy van a

Mail Coupan for Free Booklet INTERNATIONAL SCHOOL OF CHEM. STRY
Orison of the
International Correspondence Schools
See 7444 6 Streetes. Pages.
Williest cost or obligation, garage and up foll Hereste of tour hone-samp mores in

Analytical Chemistry Balantiurginal Chemistry
Chemistry Chemistry Chemistry Course
Industrial Chemistry Pharmacy

AFTER YOU GRADUATE

981 BEFRIES OF MY AMARING OFFICE

NEADEO OFFEE . Lembs

Puese Pinely, Marine Engage Letadal 196

Letters 199
Airplants
Fourters
Letters
Letters
Fourters
Fourters
Fourters
Fourters
Fourters
Fourters
Fourters
Fourters

Many Sther County-1744

Addrson

Teyro State

The He 200 Mans Black Course who has a Partiest Black Teacher to the hand of the hand to t From him to Year Point to the second second

HEMPHILL D SOEL ENGINEERIN

need of Advertising in See Dear 2162, Chicago, U. S. A.

Per Trained Auto Machanies Form than Larn I -b

क स्वाम क्या । अ अवस्तु स्वाह है। जान व अग्र अमें हैं। क्या MUSWERNY SCHOOL , WHALL



THE INSTEAD THE WATER AND THE PARTY AND TH

HOME WORKSHOP BLUEPRINTS

New projects are marked with an interial: (*)

T'O ASSIST you in your home workshop POPULAR SCIENCE MONTHLY ofters large blueprints containing working drawings at a number of well-tes of posecrs. The baneprines are 15 by 22 in and are sold for 25 cents a single sheet texcept in a few special cases). Under by number. The numbers are given in thate vie and fo fow the titles. When two or more parabers follow one ti le it means

that there are two or more blueprints in the complete se. If he let ex R follows a number if menca es that the bigearthi or set of bineprints is accompanied is a specio reprint of he instructions original v pulmshed in the magazine. It you do no wish his zero no one t the letter R from your order and deduc. 25 cen a from the price given. Reprinca alone are sole for In cents each.

Flying Auplane Models

T	
Bremen (Junkers, 3-8: Physics) 39 00 \$	50
Lindbergh's Monopiane (3 Iv Piping 4)	23
Nieuport XVII 29- n figure 180-781	50
R as off Ground Tractor 3 to 50	63
Seap and Tractor 10 in 17	1
Scop and Morris (Record 12 , min 10"	5
5 E 54 Word Wa Plane 30 n 160 160	ч
Sing a Stack Tra tor 10-in #2	25
T acros checord Freght 6.024 Fr. 104	23
Twin Pusher, Racing 35 in 44	23
Winner Mar (4-1), Byings, 147 (42-14)	75

Hoats		
Canne Saying Ouths, 25		23
Cannot 16 it Cubvas Covered Kuyah with		
Sa. 3 etc 252 29 252 M		110
With full size patterns	ž	30
Duck Boat Falsing 1"0 R		34
W b to take partern	ã	94
Outboard Racer 11 5 ft 124 ra 6 ft		3
With the hare parterns	3	21
Say boat Metorbeat Combination (5 ft ca-		
11¢ f 2.211 R		Đ
Week lut a re patterns	2	40
Mar out R g with Job for Above 1774		24
3-8s, Rowbont Motorbags, 347 #		50
With full step patterns	2	06
14 , ft Rawlings Motorboat 740 R		30
With full pice potterns	4	00
th ft. Rombnat Mutorbnat fas #	1	3-0
With to I pier patterns	,	00
State Drive Instal alian When used with	-	200
Rambout Motorbout) 250		25
13', It Bunabout or Sportboat outboard		~
or ab and mileon 175 and a M		00
W to full mire patterns	=	70

Eurutture

Bookcase Simple 27	25
Bo hate I and Birth Ends Modernistic 100	23
Booksheives Hanging 27	75
Books and Modernsetz 48	45
Book Trough, 43	25
Ceda: Ches: Mahagany Tommed It	23
Chair Rush Bottom 36	75
Chesto, Treasure, 24	25
Clock. Grundtather 19	25
Desk Co on a 27	23
End Tab a Magazine 63	25
Fires de Bench Colonia: 18 A 1466	30
Rochen Tab e Cab net 27	23
Lamps, Modern stre 37	35
M vur Scrol Frame, 101	25
Matter Stand Folding 1 td 1744	2.5
eSee page 46 for hit uf muter aler	
Pier Cab net and Corner Shrives ?"	25
Redig Cabinet Console io 1	50
5 reeps. Modern avic Folding 92	35
Sewing Cabinets Two J1	23
Sewing Table 1	75
Shetves und Lamp. Modern sie 67	23
Smoking Cabinet 7	25
Stand Low Mofernistic 100	23
Table, Garr-Leg 24	25
Table Tavern. (6)	25
Table Tet Top Oak Top 20 by 24 in 140	75
Tea Wagon, 13.	25
res as deany as.	

Radio Sets

Ampl Set. Three-Stage And a Frequency	42	25
Pive Tube (Battery Operated), \$4-55		40
Pull Electric Readphone Set. 139		7.5
Oge Tube (Bettery Operated), 103		€.
Screen Grad Se 109		2.5
Short Wave Converter Unit 137		24
Amateur Short Wave Rera ver 155		21
Amateur Radio Transmitter 165-164		JÚ

Skip and Couch Models	
Bark Scroe Hall Moder 111 am 101	25
"Barticah p- U S & Teras 3 /t Rul	
See page at for his of major an	1.00
Bottle Cippe Ship in 4.7 722	50
C part ha more & in. 2.	25
Cripte Ship 20 3 n Mar. 5 52-52 R	1 00
Construct on 2 m Hu 37 M 59 R Construct Wagner 75°, m 2 R 9 120-R	100
Destroyer- C & S Prestne 11 . in North	
f 3 78 17 R	OÒ
Galicon Spanish Tresaute 24 n. 48 4.	34
Merdower 1 , in Hall Alda Al R	1 00
M n asure Cua h and Cove at Wagun for	. 410
Decorating Bones etc. 202 R	50
Morochoat 29-in Cruseer 47.64 R	7.5
Mutanount, W hing Scale Mode, Dr ven, y Ruphe: Bands or Toy Outboard	
M et al. 20 pm 34 m21 3 Mai	25
"Line Manhattan 12 in ong 204	45
Box cage 64 for his of mater 2 a. Parate Galley of Para 4 20 to 44 45 R	7.5
Ruman Ga ev 19- n 213-229 R	75
Same-Square and Fore-and Air for any	
Mined 283 286	30
Sente Maria 18 th 11mm 74 5 6 R. Schooler Humann 12 , n 1 15 15	1 00
15 R	1 00
Sedan Chair Queen a 2 m 12 a 4	30
Stagecoach Convert 70 year 248 174	
Stagecoach (Cody with House Couch	1 00
Budy 15 n Long 146 145 fel R	00
Breambon M seems pp. 9 , n #4-95 98 R	0.0
Visa by Ship 20 , 6 01 02 M	73
Wealer-Wanderer 20 , on 151 252 252	71
134	1 00
Sale or Wanderer 285 488	50
Note that the terms of the state of the stat	-23
Yacht Sea Scoor 42-in, Racing, 204 107-R. Yacht, 29 in Racing 44 R	50
Toys	
Airpinne Cockpit with Controls, Jed.	25
B do and Anymate 56	2.5
Del a House Co on al 77	25
D 1 Press, Lathe Saw etc. f 3. Damp Truck Pres Engine are 10.	25
	47
Miscellaneous	
Log Cobin (Three Rooms), 134-R wassen,	.50
Puntien. & m 5 mpta B neb, #5	23
Too Cab het Beach Hook etc 39	2.5
Workbench, 15	23

Popular Science Monthly 381 Fourth Avenue, New York

Send me the blueprint, or blueprints, numbered as follows. No. No . . No.,..., No Ve Vn Nσ No.

Patierns for

Reprints ainue for

am inclosing . . . dollars . . . rents.

C 11 y 2 mo 15 21

Note Piece prest your name and address very riesely II you do not wish to and this page, order on a separate sheet.

BATTLESHIP TEXAS

(Continued from page V

cut round. The second and fourth should be left long, the extra part being turned smaller to fit tightly in holes in the deck. This is because the second contains the motor switch and the fourth should lift off to allow ballast to be placed in the hall to balance it. I built a small how between the propeller shafts to hold the ballast. The amount required will depend upon the distribution of other weights. If it is not a work og model, the barbettes can be glued right on the deck. The switch, of course, may be placed somewhere else.

THE guns are put in the turrets, which are fascened with a long mail. Turret No. 3 at least will have to turn, so that the fiddley deck can be lifted off. On this turret the plane catapult is fastened. Turret No. 4 should have a range finder on top to the port side, as should No. 2 if there to no switch in the way, but this one will be to starboard.

On the upper deck there is a 5-in, myldfire gun at each side pointing forward These should be mounted as shown in deand 58 The other ten 5-in, guns project from casemates in the ship's side, therefore only 13, to in of them will project and no mounting is necessary. These guns are shown in the profile plan, detail of the upper deck, and detail 5# The casemates are marked 15. They are triangular cuts carved in a the side of the had, in the angles of which are semicircular revolving plates through which the minsproject. The gons, when at rest should be horizontal and parallel to the fore-and aft line of the ship. Forward there are three similar casemates (16), but the guns have been removed from these and windown put in the first, poets in the second and nothing in the third-under the bridge

The small guns, with the exception of four anti-aircraft guns have been omitted They would go on the first bridge deck. and the field guns would be lashed on the afterdeck, I put an anti-aircraft gun (50) in each wing of deck 29, and one on each wing of the upper deck 17

The remaining details will be described

OLD RULING PEN AIDS IN MODEL MAKING

next month in the final article of the series



For fastening were parts to an extremely small ship model, I utilized a discarded ruling pen of the type used by draftsmen. Unlike tweezers, the ruling pen can be clamped on the wire or other small part thus allowing it to be held firmly in until the glue has set .-- FRANK E. CRANE, JR

I WISH [HAD SOME] SHEND NO MOREY HERES MY MA 100.16 THYE A J'IEY BICYCLE

WIN THIS BICYCLE!

His easy' Earn your own SPENDING MONEY Get this speedy more title—and your choice of 300 other prices—we'b our a cent of cost. Bike comes to you folly squipped with consist brace head ght and other big entures. But I for easy riding, song wear and speed

MONEY and PRIZES can be yours for delivering 5 we known magar ness to cultimete a your neighborhood. W. not seen eigh combine the mail start home as it supported to black Mail residents and their supported to the support of the supported to the support of the Mail the

MARL THIS COUPON AT ONCE!

Mr. Jam Thayer, Dept. 283 The Crowell Poblishing Co. Sprangfield, Ohio

Dear Jim I want to wa MONEY and PRIZES Start me as a antenmen

Address



IT'S EASY TO MAKE BIG SPARE TIME MONEY

Send for our free plan on bow to make \$5.00 to \$15.00 a work in your space time-by taking orders for Posteran Seits a MONTHLY from your friends. No se one required. Turn entre hours into exten dollars.

STUDY AT HOME

ինագ աշրաժում գործունն բարգունբություն

67.000 to \$10,000 Assunt,

den Velversity, Bept. \$834. Chiese

ration Toursell and of home day to the proof of th

POPULAR SCIENCE MONTHLY 201 Payett Aug. New York, M. Y.



New Adding Machine



American School, Dept. E 248, Dented at \$6.5t., Chicago.



into a page of physicians on Second control of the II 35 Harden, Gent.



Wrestling Book FREE



EARN THIS BROWN UP TO \$28 A WEEK, OR MORE G are Mandonestin in conf.

an tot from detail . That

MAYE BURNE SCHOOL begs. b-3, Buy 2104 Claveland, Ch.

BANK N. BAN will death per HITW to CREATE ST. OR ANNE STORE IN to bester that you can be.

at a selection I Total Leaf American Mushrupat



Tricks With Electricity

Make things to be, josep. Eich, bean, about, about, fleat, or at p. all by abstractly black tight about and don poweling, trick lights fleating rings, agir I regular all black necessary, practical devices. Book tells been to do for attents with the waits A.C. Pautpaid 17. Experienced on a state of the same persenceters tatalog free parties and principles and the Court of the



operiors of Customer Immigratel Rendrods Fature Appalacements Coming \$158 to \$225 Month Mail Caupen Gelero You Luce It

FRANKLIN INSTITUTE, Dept F-274, Ruchester, N.

P Radio to the distinct taken one of 7 page book.

How is for a time to \$70 me.

In the form wellen be (ii all give, i) been as the opposite to a teem.

100



ACUMEN

The Sharyness of the Mind

A keen mind may be likened to a sharp kulfowhich penetrates easily and quickly For clean-cut action, both the kulfo and the tailed must be sharp. So it is natural that, when a word was needed to denote the faculty of leven, penetrating thought, the Latin word for "aborphese" should be horrowed. Accert, in Latin, means "to charpen" and occurrence and should be removed and used it figuratively for charpeese of the mind. There are thousands of such startes about the origins of English words in

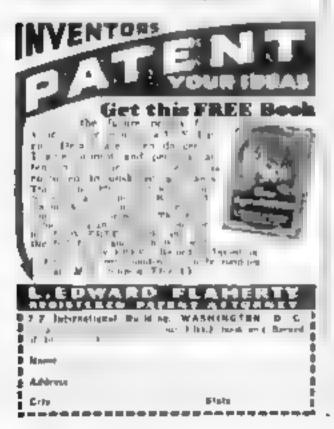
The "Suprama Authority"

WEBSTER'S NEW INTERNATIONAL DICTIONARY

a Mussian Water



Always mention Portlan Science Monthly when answering advertisements in this magazine



AGENTS SAVE FARMERS FROM CROPSHARKS

(Continued from page 30)

a new idea is concerned, you should observe the actions of the crop-reporting army that must prevent the misuse of its information.

Field representatives relay information, usually by telestraph, back and forth among the various branch offices, so that all parts where such information is of value will be served. It would be almost a physical impossibility to send to Washington for redistribution all of the facts collected

However, periodic crop information is sent to Washington by field men, and it is this that forms the basis of prices of agricultural products—prices that you pay for many of the things you cat and wear. Reports are surrounded with the greatest secrety while in the hands of field men, and are transmitted in code or by mail to Washington where they are dropped into a locked mail box at the Secretary of Agriculture's office. Finally they become the basis for a ceremony, most of which takes place behind locked doors

DATES for crop report releases are fixed by law, and are varied but slightly to ac commodate buildays and Sundays. There is one report every month during the crop-growing season, usually during the first ten days. On the appointed day, the chairman of the crop and livestock board, and one other board member, accompanied by a guard, proceed to the Secretary's office. They get the reports, which are in the special mail box in the Secretary's office, and take them to the board rooms—still accompanied by the court. Once inside the rooms, the doors are locked, and are kept that way until the board report is released.

In the new asyncultural building, the grop reportent board meets in a special section that can be closed off from the rest of the building Here the board members and a corps of some half-hundred statisticians and clerke labor. sometimes throughout the night, until final tabulations have been made. Because the information that is being handerd is of almost unbelievable value, extreme precautions are made to prevent leaks. Premature announcements mucht upset market values the world over, or might be used by speculators for private gain. Even more important than most war secrets, is some of the grop and Hyestock data. In the past, there have been occasional rumors that inturmation has leaked out but no serious leak ever has occurred

TODAY, it would be practically impossible for a clerk or other person in the secret chamber to give out signals that an accomplice outside might pick up and relay to speculators. First, the law prohibits employers concerned with crop reports from speculating in agricultural products, knowningly issuing take information, or giving out information of any kind concerning forth-runing reports. The miximum penalty for violation is a \$10,000 fine and a 10-year emprisonment—not a pleasant reward for a bit of dishonest signaling

However there are precautions taken against lenks. Because every single figure concerning crops or stock is a summary of many other figures from various sources, the final information is not available upt. a few minutes before isonance of the report. The work of compiling information is arranged so that all final figures for all crops are tabulated at about the same time. Then, in addition to the locked doors, window shutters are locked in a closed position to prevent signaling to outsiders. A special locking har, sented in mace, is used for the

As the reports are prepared, they are set up on machines for numeographics. The Secretary of Agriculture goes to the board

rooms blicen minutes before the release time, and approves the report. Then the charman and two other members are escorted by a guard from the heard comes, down the half a hundred feet and around a corner to a premaroom partly filled with telephones and telepraph instruments. Here representatives of the press, of market exchanges and other interested groups are waiting. Copies of the report are placed, face down, near each telephone and telegraph instrument. At a signal from a representative of the office of the Secretary, a mild form of pandemonum literals loose, as each reporter starts giving out the news.

Need for haste has been leasened somewhat by a new role that closes grain and cotton exchanges for a short period, starting fifteen minutes before the report is released. This gives everyone in the trade more of an even break. After the first release of the report, the board chairman and other trembers go to a local broadcasting station and send the report out over the natio to millions of farmers and other interested persons.

As FOR the farmer, his direct benefits include information that will guide him in increasing or decreasing the amount of wheat or torn or polatices he will plant, or the number of hogs he will raise, and suggestions as to holding or selling particular products. Then, indirectly, crop and livestock reports prevent the distribution of inaccurate, false, or candeading statements by speculators and others; reduce speculation tendencies, help railroads and other transportation companies in knowing how much bassing equipment to provide, and where, and result in better distribution of farm supplies and equipment

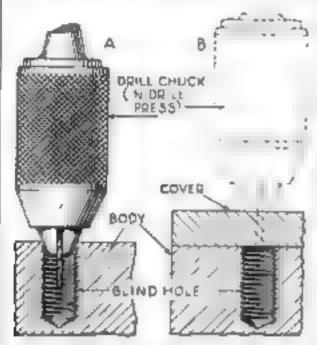
One circus studies farm and crop reports before it maps out its summer travels, thereby making sure that it will visit the most projperous farm communities. Many banks use the reports as a basis for anticipating demands for loans from farmers. Manufacturers and sellers of faces machinery and equipment employ the reports for allocating their produris, so that there will not be a shortage me items during harvest seasons. Rid roads distribute their cars in a similar man ner. One large automobile manufacturing cubecen uses crop reports to if they were mans to burted treasure-to locate areas where farmers have money that they may street in automobiles.

ONE of the largest soap manufacturing companies studies hog and culton reports for the purpose of mapping out its raw materials purchasing program. Advertising agencies direct their campaigns line districts where reports indicate there is a demand for products concerned. Fundies desiring to move to new territory study reports to learn where the type of farming they wish to follow may be most profitable.

And so it noes. Uncle Sum has good reason for operating his gight news-gathering system. -a system whose traffic is an important that automatic printing machines are too slow to be used in restring movinges, in sproothding be activities of more than 2 700 of his extployees with such secrecy that not even the Secretary of Agriculture can learn what the periodic crop and Evestock report contains until the moment it is released, and in guarding the activities of his crop reporting staff while in action, with severe rules and special mechanical devices for eluminating the possibility that information will leak out and create havor with food prices, or affect the incomes of thousands of persons who grow things for a living.

TRANSFERRING LOCATION OF BLIND HOLES

IT IS a tricky operation to transfer the locations of blind holes from one part to another part that has to be drilled to match, but there is one simple method anyone can use. First, clamp the piece with the bind hole, or holes, to the drill press table. Then, with a small drill gripped

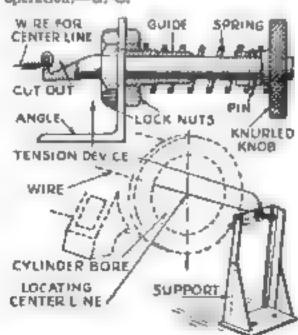


A small dr II to contested to the himd hole and then used as at B to dr II a pilot hole

in a friction chack, center the hole beneath the drill by using the jaws of the chack as shown at A. Now raise the spinule and put in position the piece to which the location of the hole is to be transferred and crite the hole is to be transferred and crite the hole is to be transferred and crite the hole is to be transferring the method successfully for transferring the doles from a midera to new covers for making templates, and for similar types of work—W. H. Mooke

TENSION DEVICE KEEPS STEEL WIRE TAUT

WHEN machinery is bring effected the device illustrated below will hold a steel wire taut so that center lines can be accurately determined. It can be used for many purposes, but was designed especially for locating the center line of a steaming he cylinder. The perspective sketch shows a stand made for this particular operation,—G. C.



Center lines can be run more accurately if the wore in attached tast with this fewice

and TRADEMARKS FREE Bo

Patent Your Ideas Free Book Shows How

YOUR idea for a practical article or an improvement upon an old one should be patented NOW. Frequently many of the thousands of applications filed in the U. S. Patent Office each year are for the same or almost the same idea, In such a case, the burden of proof rests with the last application filed. Sometimes a delay of even a few days in filing the application means the total loss of the patent. Lose NO TIME.

The entire time of my large and experienced organization is devoted exclusively to patent and

trade-mark cases. We know the rules and requirements of the Patent Office. We understand the technicalities of Patent Law. We can proceed in the quickest and safest ways in preparing an application for a patent covering your idea.

The book shown here contains valuable information that every inventor should know. It tells you just how to go about obtaining a patent for your idea. With the booklet I will send you my "Record of Invention" form on which you may sketch your idea and establish its date before a witness. If a cospute arises this will be valuable to you send the coupon TODAY! You was receive the FRFE, book, the "Record of Invention" Form, and full information regarding costs.

Strict Secrecy Preserved

All communications, sketches, etc., are beld in strictest confidence and protected by steel files. Your (dea will be in trustworthy hands, I have the highest references. It is probable that I can help you. Send the Coupon AT ONCE.

Personal Service

Your case will be handled by a specialist selected for knowledge and experience in certain lines of inventions. His personal attention will be given to your idea.



ALSO FREE

Series of Invention.

Dishib the series of t

the man to a state of the control of

Clerence A. B'Briss Registered Fatest Attorney 60-T Adoms Building, Washington, B. C.

Photos word me your Perc Book. "How to Obtain a Patent." and your "Record of Invention" form, without any cost or obligation on my part.

NAME

ADDRESS

(Important: Welto be print name plainly)





Start Your Own Business

The the is other this five photograph above in the light might for mink that it is to be about the hardware and to be the about the five days were got the five to be about the five the second of the

A month-off, how sign time an non-five brings fived operating a country the mean and most for a vital and most for a vital and most for a five Yakana parable states a five of the states of the states of the simple fived operating five parable from the five of the simple five operation to the five operation of the simple five operation of the five ope

Costs Nothing

To get full fact. Here all altastical foods of the state of the state

A. H. Adants, Prestdent Vita Sould Pointo Ch p Co. Post 3 1814, 500 ft Feebowsk, Cheep, ft.

50 MEN

Winther to set nha las made when her made the transfer to a street of the street of th Partie Alle Fille E. Ste obligations



SEND NO MONEY

Daily a word limited standard of those formed Man Cangage statistics of this partial form from multiple of their partial form from multiple of their beautiful to the theory from a first standard of the rest of the first of the

Over 180,000 Settefied Users or ground to real Typegen of any discharges Carpes Diversors Head the Payers F O T Strongs for Distance treated the charged one gates effected by any and partie are associated from principal for a sense of this at 10 ft is described to a good \$2,000 describe until before paid \$20.000 to sense. Manage Address Times Olea Batarin +

PATENTS-TRADE MARKS

All cases othersitted given personal attention by members of the firm.

Information and Booklet Free

LANCASTER, ALLWINE & ROMMEL PATENT LAW OFFICES

\$3.6-45th \$5. 7t. 40. Butte 43.7t.

Washington, D. C.

OLD WORDS GET NEW MEANING IN QUEER TRADE LINGOES

Continued from Page 20)

a bole of smaller diameter in order to restrict the flow. Later when the well stopped flowing, we started pumping it, but it filled up with sand "

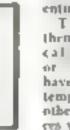
The lingo of the oil fields is rich in terms describing every operation and piece of apparatus used. In many cases these slang terms seem to be the only ones in existence, for they are used in the Itade journals and reports of oil well operations

The assembly of pipe connections and values at the top of the cause of a flowing with 6 concerls summed up as The Chr. I. the Tree. To drain off water or imputaties at the bottom of an oil tank is to threat it A "fish" is anything lost in the bole which must be extracted or evaded. To "get a hone is to encounter hard rock in drilling. To "skid the rig" is to shift the derrick for draking a new hole when the old one cannot be continued. The "stool-pigeon" is an instrument recording the weight supported by the detick in the hole-and hence a "detective" showing how many feet are diffled in a day

Miners' Terms

"O'Al, in ning would seem to be somewhat Cost, maning with the area eliment

of trade words is entirely different



The laborers themselves are often called "murkmen" or bunkses" They have a hearly contempt for all of the other mine employces who work above ground, and express

their supposed uselessness by the epithet, Company Justers

The exposed or workable part of a coal vein a called the face. To enable the monty to get foanable roa easily he has a machine that cars away a luyer, a few inches in height, from the bottom rulge of the fair-The fine chips the machine produces are called bug duct. After the coal + ha led into the wagons, if is drawn to the mouth of the mine along the e-h total. Water that has leaked into the more collects in a pit called a some before being pumped out When a part from its boilt answhere in the more to an prove the ventilation it is parced a "brattah

Between the Acts

"HE triumvirate that rules the setting of The stage is made up of three potentates, Carpe," "Props," and Jame In other words, the state-turpenter, the property man, and the electrician, Each of these captains has under his command a company of helpers which is known by a name as distinctive as his own. The helpers of Carps" are called grips, the satellites of "Props" are named 'clearers," and the assistants of "Juice" are labelled "operators."

There is an excellegt reason for keepng these terms for beiners distinct, for many of them are floaters ' or trapsient workers, and the three beads of the buckstage arsangements have no time to learn every

new assistant's name "Catps" merely needs to call "Grips, strike I" to have instant attention and obedience from his entire staff. They will set to work at once dismantling the set-

The "grips" will "skate" the "flats" that compose the scene across the floor to the ude or back wall of the stage. A similar order from "Props" to his "clearers" will remove the furniture and bric-a-brac from the set And meantime "Juke" and his "operators" are busy read asting the "pockets" (floor plugs), "bunches," and "spots" med in the art hist finished

Movie-Studio Slang

WHEN a stage play is put on the film. VV spoken lines and all, the buck-stage ango of "Carpa," "Props," and "Juice" is replaced by the special diarect that has grown up around the technique of making talking picture

The set is called a "live stage" when it is enclosed by materials that do not absorb much sound. Where it is necessary to prevent sound being reflected or echoed, a portable wall is used, covered with sound-absorbing material. If it is not intended to be photographed, it is a "gobo." If it is to be shown in the picture when produced, it is a "wild wall" (za joskev wa 1)

Off at one side of the set is a soundproof booth called the "aquacism in which terminates the circuits from the microphones being used on the set At the controls of a piece of appuratus



in the "squartum" atta the "maxer" or "monitor man," derisively called a "dial twister." He blends the sound coming from the various interophones so that the recording apparatus

will receive the proper intensities. When all tests have been made in the sound-on film reproducing system, it is reported to be "O K, on the blops!" And after the sound-on-rise or play back system has been tested similarly, it is reported as "O. K.

on the clicks! At last all is ready to proceed with the action of the ecene being filmed, "Lock 'em up!" in the command, (Close camera booths

so all noise will be kept mut-The next orders are Hours the chate! On the line! Give 'em A C 10 (Send sound into the amplifier room and switch all recording motors into circuit Start synchronization of camera and recording motors)

When the scene has been shot and the "inkies" (incamiescent lamps have been turned off by the "gaffer" head electrician) and his assulants, the day's film is sent to the developing inborntory for "rushes," or da hea." In other words the films are developed and printed overnight for trial projection next day

When a sound film is projected at varying speeds, the interference of the sound waves in the theater auditorium may develop any one of four different defects-"wow-wows," "flut-ter," "gargle," or "whiskers." Also poorlymade splices in the sound-track of the finished film may cause "bloops." And Snally, when the sound-track runs through the pick-up out of line so that a little light passes through the sprocket boles, a disagreeable hum is pro-

duced. This is called "sprock " The trade lingo is simply a habit which is the result of humanity's clan instruct. Every vocation-group feels the need of having its own exclusive patter. Hence it develops a language composed of English words to which it gives entirely new and unexpected meatings,

CHEMICALS TO MAKE IN YOUR LABORATORY

(Continued from page 57

sulphate or Epsum salts—the same substance user. In the beginning—with result

Many chemicals can be made by immersing a meta, in a chemical solution. An irot nail placed in a solution of copper sulphate will become plated with copper If allowed to remain in the solution for several weeks, all of the copper can be obtained from the solution in the form of a brown powder. The solution, when liftered, contains from sulphate and can be used as such.

Sim ar processes in the same way produce other chemicals. The novel lead tree described in a recent issue P.S.M., Dec. '32, p. 35, 100-16 lead crystals and rine acetate. Incremts v. lead trees can be preserved as a currently by placing a lover of oil on the surface of the liquid to prevent evaporation and exclude the air.

Dry chemicals as well as liquids after react to form new substances. If some powdered lead narrate crystais, which are white, are mixed with per asser minering powder which is white, vellow lead mine powder which is white, vellow lead mine powder is common Thurwagh mixing of the two chemicals can be obtained by placing them in a pill box of stopperer bottle and shaking them yigorouses.

When sinck by the hinter about by with chemicals, acids shown be kept in glass at opported bottles. With the en epitors of aminima water, which should preparately be stored in a last atoppered bottles, most alkalies in a ation may be stored in bottles having rubber corks.

If ord nary corks must be used and they are arts seed by the chemicals, coat them ght y with hot was to as stoppers that the not fit their bottles sneaty can be accound to a perfect fit by placing valve granting compound on the stopper, inserting it in the bot the neck, and twisting it back and onth an moving it up and down. The common it will wear both surfaces to make a perfect fit

Many common household a betalies I and in the kitchen and in the measure shelf can be used by the amiricar in became laborators basing so in the amiricar in became as chemical's known as sud-am bicartichate and can be used as such. Addit onal everyday substances and their corresponding chemical names are listed on page fifty-six.

NEW TWO-PLY STEEL IS NONCORROSIVE

Ariza several years research work, a multiwestern steel company reports it has socceeued in producing a creap non-cocrosive metal by "laminating" or attaching a thin ascer of sin niew steel on less expensive cartion stee. Produced by a patented process from a composite ingest, the new two-pls steel can be stamped, welded, formed, and polished, according to the maker, and can be sold at a price that will permit its use where solid stapiess steel would be prohibitive in cost

SUNSHINE SPOILS HAY

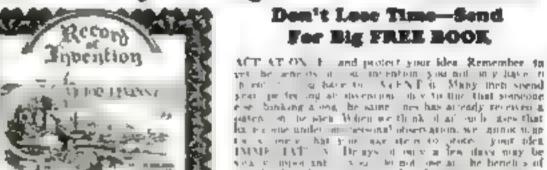
The proverb, "Make hay while the sun shines" has been amended by Prof. E. R. Hensen, farm crop expert at the Iowa State College. Too much sunshine makes poor hay, he reports. The best resu is are obtained, his experiments has shown, when the grass is cut in the afternoon and raked into windrows the following morning, as this allows the curative processes to proceed more effectively

15,000 WEATHER TERMS

FIFTEEN thousand weather terms have been compiled by the U.S. Weather Bureau. They include five hundred names for winds and thirty for hurricanes.



Little Ideas May Have Big Commercial Possibilities



Mail the Coupen for FREE Book Today

I me hard work in pranting and perfecting your invention.

It is if remembers important a limit you file your application in a patient of our a by the track, a larger, how to present that you have been along the color in game a and he as you are a mater of our reasonable from the place which say a few at a few and mark for Take he first about manel as four and patient from his he was at our life to send along a said begind for the a set of the other which the following a few and a a bar of the others which the place of a stellar manel.

Righest References—Strictest Segrecy 33 Tours of Proven Service

The decembers of this Grow of Victor I People & Compression of the cost A or Oral count and executors? Our equation of the cost cost and executors? Our equation of the cost o

Here's How We Operate

A some on the discription of pure inscription comes ands such of a color of terms at a color of the great open and open at the color of a color of the color of t

Here's What the Coupon Brings. Half It How

Might the response testay and take the first step assign to present on a sign of a first still peopley. By the a first a first



VICTOR J. EVANS & CO Formal time man the source VOW VICTOR J. EVANS & CO Formal time man the source VOW REGISTERED PATENT ATTORNEYS MAIN OFFICE 440-BB, Victor Building, Washington, D. C. BRANCH OFFICE 1840 BB Coway Building Chicago, J. C. BRANCH OFFICE 1840 BB Coway Building Chicago, J. C. BRANCH OFFICE 1840 BB Coway Building Chicago, J. C. Branch Office 1840 BB Coway Building Chicago, J. BB B: solway New York 1848 RB Felority Ph sadelphia Irust Building Philadelphia; 314 BB Emple Building, Fittebergh, 1010 BB Hobart Building Sen Francisco.

the the frequent feeter and he addition to the feet back up to such our bears to a getter of a large when he per to be a compared to the many the period to the many two of a part of the compared to the comp

W TO OBTAIN A

-WASHII

Piese send me your free book, "How to Obtain a Patent," and your "Record of Invention Black

Name

Street and Va.





Mine Cher NYENTORS.

model het combination MILLER& MILLER, Patent Attorneys PORMER MEMBER EXAMPLING COMPS TO 5 PATENT OFFICE 1' to Wood with Body Dept No. 10 1 265 EARLE Be of No. WASHINGTON D. C.

Arthitist

I tell you how and help we make the tale. Free par a ars at a stighted)

Write W T Greene a diameter Bidg

Inventions Promoted

Parented or Unparented. In husiness over 10 Band drawing and draues of an or model write for information. Complete factures References

ADAM FISHER MFG. CO. 183-D Enright, St. Louis, Mo. PATENTS SECURED

Trade-Marks Registered I offer you the advantages of my 31 years coperationed as a patent lawyer and sanute you of TERMS REASONABLE
Rock and Information Free

L. F. RANDOLPH

340 Victor Building

Washington, D. C.

FIRESIDE MOUSTRIES

Magal. 57-8,

135 F. U. N.W Dapt. C. Washington, D.C. Established Lotel



\$158 to \$225 a Month

MASS COUPON BEFORE YOU LOSE IT

FRANKLIN INSTITUTE, Drot. F ZIII Machenter, N. Y.

8 8 20 5 5 6 8

10

OF AM S A

AMERICAN SCHOOL Dept. II. or DesertAs & John St. C. a. F. 1997 (1) C. A. C.

BECOME AN EXPERT

LoSelle Extension University, Occ. 3th Lt.



"Our Readers Say" is getting to be one of the most diverting and interesting features in the magazine. If you have not written in to the Editor of "Our Readers Say" why not break into print with some idea that you are interested in. Your letter will be welcome.





Address ... Chur-State

WHAT TO DO WHEN BRAKES WON'T HOLD

(Continued from page 62)

from the bench and examined it. It seems In me automotive engineers night to be able to perfect some sort of brake lining that won't wear out," he said. "They make bearings that outlast a car "

Bearings and brakes are two different things," Gus reminded him. "In a hearing we try to reduce the friction between the parts by using a lubricant. With a brake it s just the reverse; we want as much friction as we can get and wherever you have riction, you're bound to have some wear, Your brakes were labricated and the friction was reduced. That's why they didn't hold

"I can give you a heavy liming that II wear ake con," thus said as he listed a roll estaling from the stock shelves, "but you won't ar it Hard hornes are noisier than solt ones. We use this heavy lining on trucks,"

"SHOULD brake linings he set at any defi-nate clearance from the drum-c" Runkin asked.

External brakes will bind if they're set up t w got " replied Gus, "The heat generated he fraction causes the bruke dram to expand On interpal brakes, it's a little different, since the expanding drum moves away from the linings and shoreuses the clearance. Interna) brakes can be set up a little tighter than external brukes "

"I ve never had much luck trying to reine my uwn brakes," Rankin contessed to be watched Gus equalize the brakes with a portable hand tester that clamped to the rim of the where I suppose I pever learned the Anack of it."

"It's easy when you know how " chuckled Gas but it's a track not many car owners w wish

The thing not to do is crowd the lining too much when you apply it. After I've renext a set of brakes and adjusted them, I drive the car for a few handred feel in second gear with the brakes partly on. That helps to mostly out the imme and orces it into place Then I readjust them, if it's necessary

"When you're adjusting mechanical brakes don't louch the bacage unless you have to-That'll be set right when you buy the car, On most brakes the tranks and pull rods bould be at right ancies when the I rakes are full applied that gives the greatest possible

"That reminds me," Rankon interrupted Ken Dayle, next door to me, mys you should afways have two or three people in a car when you make any brake adjustments. Is there anything to that idea?"

That's a good thing to do sometimes," Gus agreed. "You see, on some cars, the rear sair may shift a trifle when the car is loaded and that opsels any adjustment made when the car is empty. By working with an average had, you can get an adjustment that will be fairly good for all conditions,"

How quickly should you be able to stop with four wheel brakes?" Rankin asked when Gus had completely the (0):

Well," Gus replied after a moment's conediration. You ought to be able to stup your car easily in about twenty-five feet when you re going twenty miles an hour, Trouble s, most people don't pay enough attention to their brakes to have them work that well. It they did, you wouldn't read about so many accidents.

"The average person thinks more about color schemes, horse power, and cigar lighters than he does about brakes. Take my advice-Ned, and test your brakes as faithfully as you change the oil in your motor. You should never forget that your brakes are the main salely feature on your car"

This One

•

The Salvation Army Slogan During
The Past Months Has Been

Hunger Knows No Holiday

OLLOWING a Winter during which greatur dumands then over before were made upon the organization by the poor and nearly, the wer against paverty and distress was resulutely carried on from over 2,000 centers throughout the Summer, Thousands of homes were saved from disaster.

DURING THE PART YEAR OVER FIF-TEEN MILLION APPLICATIONS FOR ASSISTANCE WERE MET

GAIN Winter comes with increased cries for aid from the victims of unampleyment and other ills. The Salvation Army ferms the shock troops of social welfers. It meets the first impact of human need. Its capacity for succer lies in the generality of its friends

HELP TO THE EINST OF YOUR

Mall Your Contribution Today Tet
COMMANDER
EVANGATINE BOOTH
NATIONAL BESTIGNARTHER OF
THE SALVATION ARMS
120 West 10th Street
New York, N. T.

er, if you prefer, to your local resident efficer, Gifts may be allegated to any specific purposes or district.







FORMS TO CAST LASS SQUEEZES, MICHAEL TRAFFILMS, STREETS, gold and From the spain Winner. From he resided. Easy and large-species he make " toroich all moditables thatterial bond to State or Physics of Englishma.

Hunry C. Schiercke, Ghont. New York

This Book Has Belped Thousands to Success

The Real Estate Educator

The New Heatest Earling, can a de Agreetines deal Ansieres Habites In the Laws among of store a ship! Throws he Boy I care and in a caring Hamiltonian appears a Prop. a see of heat 3 are flowed at Allera to Allera heat in Continents, one in Agricus here in Continents, only 244 pages. Chath, Postpand \$2.08.

The Popular Science Monthly 301 - 4th Ave. Sew York

HOW DETECTOR TUBE HELPS RADIO WORK

Continued from page 61)

this way, the grid voltage, as illustrated at B in the drawing on page 61, causes the plate current to decrease varying amounts, as illustrated at C

The action of the grid of the tube thus eliminates one-half of the incoming alternaling wave and produces uni-directional variations in the plate current which in turn, by means of carphones or loud-ocakers produce stable that are accurate disputates of those entering the microphone at the transmitting seation

IN THE grid-bias detector, on condenser and grid leak are used. Instead, the grid is operated theoretically at such a voltage that with no signal entering the system, the plate current is zero. In other words, the grid is given an initial negative voltage by some nutside means that stops the flow of electrons from the cathode when no signal is received to upset the balance

bince the grid is already negative and no plate current flows initially, the negative alternations of the focoming wave have no effect on the plate circuit. Being zero, the plate current can be reduced no further no matter how negative the grid becomes. The positive alternations, on the other hand, increase the flow of electrons to the plate and thus increase the current flowing to the plate circuit. In this way, the negative had of the incoming a ternating water the climinated and the positive had produces value as in the plate current in one directors only as at D.

So far the consideration of the grid litariletectur has been entirely the stetual in practice, the grid-bian voltage is made sightly less than the theoretical value so that with no natial entering the elecuit the plate carrent is not actually acro but is very small. The negative half of the wave is then not entirely eliminated but is greatly relieved in comparison with the increases of the positive half. The fluctuations in the plate carrent of an actual grid bias delector then take the form shown at fi

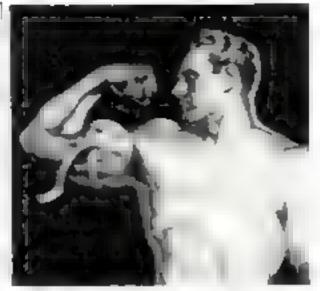
In both the grid-leak and grid has ofter for election, the radio-frequencies are bypassed from the tirruit by a condenser connected from the plate of the tube to the cathode

IT IS interesting to note from the place our rent curves of the two detector a stems that in the contenser-and leak detector the place current is decreased from its unitar value and in the grid-bias detector if is increased.

In the next article in this series on the fundamentals of radio, the so-called "characteristic curves" of tubes will be discussed.

STRONG INSECT POISON NOW MADE CHEAPLY

A KEW menage to destructive insects is the development by 6-5. Department of Agriculture chemists of a means of making synthetic tolehone economically. This poison, described in these pages (P. S. M., Nov., 31, p. 44) was Originally made from derris, on East Indian. plant, and the roots of cube, a South American shrub. The cost of rotenone, ten to twenty dollars a pound, has been too high to permit its use on a large scale. With the discovery hy Doctors F B. LaForge and H. L. J. Haller of the Department of Agriculture, of a method of making synthetic rotenone, it is believed that this inserticide will soon be numbered among poisons available to farmers in their war on insect pests.



*I will add 2 INCHES TO YOUR BICEPS

...or it won't cost you one cent!"

Signid: GEORGE P. JOWETT

Two sold inches of tough, sinuous muscle added to your beeps, or it was a cost you one penny! That s my unquashed guarantee... it means that I litake you, whether you are big or small, strong or weak, thin or fat, and add two full inches of muscle to YO! It hiceps! If I hadn't accomplished this for thousands of others ... if I wasn't shaolutely sure that I could do it for you... I wouldn't dare make such a startling guarantee!

You will not only increase your biceps, but every part of your body will be developed proportionately..., I will add at least 3 inches to your chest ... I li give you lithe, muscular legs that will be columns of power for speed and endurance ... I'll make your whole body vibrate with muscular energy, pep and health!

Take my full course and I will guarantee to and 3 inches to your chest and 2 inches to your becept or it won't cost you one penny?

Try one of my seat courses NOW prove to postelf that you tou can get a sixteen tach bicep?

Send for "Moulding a Mighty Arm" A Complete Course for ONLY 25c

It will be a recolution to you. You can't make a mistake. The guarante of the stining of mineral map in the world or not be bested for course I give you of the method of or of he liquidated and expented as you do store in both a your can go on polyreshable grate of size and a liter down gran Mark pour or be sum to be a down at the course of they are residented by prove of only.

I was not that you to up even I can develop any part of a fix agr hash. For our case of the up of lated bears at the Ot, try all pup of them for our \$1.94.

Rush the Coupon Today

Matty or order now and I will tended a 5, 15, Cottle
of RERVER OF STEEL MORCLES LIKE 1928 In

15 to a 5 to the first part form and one is leaded.

The will be a to a set to a first part form and one is leaded.

The will be a to a set to a first part form and the first like
typics of the first Branch Cutt-Grasp This She is User.



* Harries of Short, Markets She Ires The Mentides and Public Area, 250
Stopped by a latter in the 250
Monthson a latter in the 250
District on a latter in 150
District on a latter in 150
Providing bits in a latter in 250
Providing bits in a latter in 250
Att 6 Books for \$1.09

Name	
#ddres	



Master Home Mike New 1923 Madel Camplete with Mike Ring and Handid

POSTPATE Based p-objects. rede the

Martin Wile Co., 4612 Grand Street Sharolt, Web.

PRACTICAL RADIO ENGINEERING

New Times are happen-ing in riche Liverings descript March the man property of the at the

RCA INSTITUTES, INC.

Sopt. PM-2 75 Variet Street

Now York







THE AVIATION MANUAL

This said making a possible of the field by referred of deligious as long on a become high droughed restoring in a a term flow here here on it gives no too a post side to a realist appear of a desirable of the new for This Ar at too. Statement with a restoring to the appear of the statement of

REGULAR PRICE \$5.00-

NOW ONLY \$3.95

With Your Name is Gold On The Front Cover

Note you may have his been full gold edges at around for
men for the fabrihised a chifull gold edges at around for
men for the fabricated in the full gold edges at around for
men for the fabricated back as a special compowers or to
me to the fabricate about the matter than the state of the
matter than the statement about the matter than the
ar all saccaded. Copy and make the receptor to day.

Problems of the fabricate that the receptor to day.

Popular Science Publishing Co., 26) Fourth Avenue, New York, N. Y.

The e send me a copy of the remains \$5 mileton of the first condition of the first condition of the first condition of the first condition with full gold effect and me come in model on the form ones I am a past be pushed on the first copy one age when the book are sen The will may be for for the Vigoria IT I am it as deed I may resulted book within less dark and Fee day refused my manage 2 33;

2486	-		
City		Biate	
Address			

DRUGS BRING NEW ERA IN SURGERY

(Con much from page 34)

In the old method of administering ether, drop by drop, on a gause mask, the evaporation of the volatile fluid often reduced the temperature so much a coating of hour frost covered the gauze. At the end of the second. stage, consciousness is lost, often abrupt's

It is during the third period that the operation is performed. The patient is in a deep sleep. His pulse has increased to between eighty and 100 beats a minute. The pupils of the eyes, previously dilated, have contracted At this stage, a larger amount of anesthetic enarges the pupils, a smaller amount contracts them. Breathing is deep. stertorous. A soft swore is a more sign of a good greathetic.

ELECTRIC anesthetic machines, and bat teries of cylinders filled with different vapors under high pressure, are now part of the equipment of many hospitals. Watching the dials, the expert in charge controls the strength and flow of the anesthetic by means of levers. Besides keeping the patient unconsclous by replacing the ether lost in breathing, he must watch the type of tissue through which the surgeon is cutting. Some tissues are more sensitive than others and when the surgeon works with them, an extra amount of enesthetic in required to prevent palm and

During this third period, the anesthetist, or expert in charge, must be alert to every danger signal. He watches his patient like a bawk, concententing upon his pulse, his respiration, his blood pressure, his eyes, and his color.

The patient's color is of prime importance It indicates whether he needs more or less oxygen in the anesthetic vapor. Jaundiced persons and Negroes, consequently, are difficult subjects for the doctor in charge of the anesthetic during an operation. In Negroes, he watches the lips and the color of the blood at the wound. A special instrument, known as a "baemozometer," which indicates variations in the color of blood with extreme accuracy is sometimes employed under such conditions

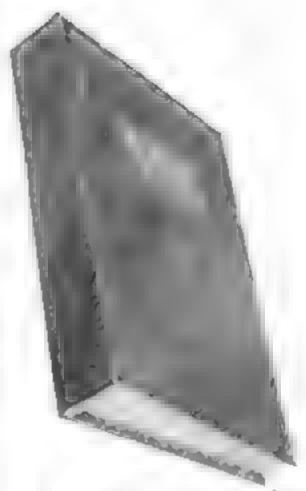
Brain operations are also difficult problems for the anesthers! The face of the passens is hidden by towels. By changes in the shade of the blood or the color under the fingerpails, he judges the patient's needs

I recall one striking case in which a brain operation in Philadelphia, Pa., lasted more than two hours under unusual conditions. At the end, the doctor in charge of the anesthetic was exhausted from the strain,

A middle-aged woman had been strapped upright in an operating chair under the big hight while ball a hundred visiting surgeons watched a famous brain specialist demonstrate an innovation in his work. Without disturbing the eventus muscles and nerves. he land back a flap of the o on the scalp and then cut through the bone of the sku mak ing an opening an inch and a ha f in diameter Taking a metal hand, shaped like a spoon handle he asserted it in the opening. All the ligh a in the room snapped out. The surgeons in the rising tiers of seats leaned forward,

SUDDENLY, there was a dull red glow within the patient's skull. A tray electric light at the end of the metal band had been switched on, solving the big problem in brain surgery-ecting sufficient illumination within the skull. However all during the operation, the anesthetic expert had to work in practical darkness, unable to see his patient, judging her condition by other indications than changes in color

A new aid under such conditions is a heart speedometer an (t. encioned on page 103)



Keep Your Copies of "POPULAR SCIENCE"

In This Beautiful New Binder

There is so much useful information in Popular Science Monthly that many renders have asked us to supply them with a blader in which they can keep a permanent file.

To meet this demand we have had draigned a beautiful binder. Bound in deeply embossed Actoraft (looks like tenther—lasts (orever) with the name of the magazine and campo design stamped in 24 Karat Gold on the cover. The binder will securely hold 6 copies of Popular Science Monthly.

New copies can be alipped into the Big-6 it ador as sary at inserting a letter in an enve-

There is nothing to get out of order—so crews to work louse, so keys to get lost. This broder will last a livetime

The binder is as beautiful as it is uneful-fit will be an ofnament to any illurary table.

Only \$2.00-Postage Prepaid

Sought in a store this binder would cost you \$1.00 or more Because we are having them made in quantity for our readers we can make you the special price of \$7.00 including all deliveall appeared

Provide the no Monthly 184 French droppe No. 3 and N. V.

The chair one went Dirg & Bitteler insued to despite embraced to the his point Direct Monthly which respine to the fee of the point of the control of the chair o

It's Easy To Make Big Spare Time Money

Send for our free plan on bow to make \$5.00 to \$15.00 a week in your spare time by taking orders for POPULAR SCHENCE MONTHLY from your friends. No selling required. Turn extra bours into extra dollars,

POPULAR SCIENCE MONTHLY 361 Fourth Ave., New York, N. Y.

Please and me full information (see on how I can make hig money in my space time

(Nume)

200

Address

DRUGS BRING NEW ERA IN SURGERY

(Continued from page 102)

instrument known as a cardiotachometer, which has been invented by Dr. Ernst P. Boas, of New York City. It amplifies the beating of a patient's heart 6,000 times and gives instant warning of the approach of a crisis.

The fourth stage in an anesthetic by ether in fortunately rare, it is the stage of the overdose, when the patient reacts unfavorably. A thready pulse, feeble, uneven breathing, and dilated pupils which do not contract when exposed to light, are the danger signs. The anesthetic is instantly stopped and stimulants are applied.

ONE of the first signs of recovery from an anesthetic is a slowing down of breathing. The rate often drops to twenty inhalations a minute and sometimes less. As consciousness returns, the odor of the ether on the patient's breath usually causes vomiting. Gause soaked in vinegar, essence of orange, or other aromatic oils, is often placed under the nose on the upper lip to kill the ether odor. In some hospitals, the fumes pass through containers of such volatile oils and reach the patient with a pleasing scent. This is not necessary with nitrous axide, for it is practically odoriess and has a pleasing sweetish taste suggesting burned sugar.

In Akron, Ohio, a few years ago, a spark from an X-ray machine touched off an explosive mixture of ether in an operating room. The blast shattered part of the apparatus but, fortunately, injured no one. Because ether is highly explosive, special precautions are taken in all operating rooms. Mercury switches prevent sparks; metal strips in the floor carry off static electricity; chalos from the legs of the operating tables and anesthetic machines ground them to the steel of the

Ether is two and a half times as heavy as air, so during an operation it descends and forms a thin blunket along the floor where explosions are likely to occur. Ethylene, a new anesthetic gas which is increasing in popularity because it produces a deep sleep lasting longer than that resulting from laughing gas, is also highly explosive.

One of the most important recent innovations is spinal anesthesia. Neocaine, a French drug, is injected into the lower spine, deadening the abdomen and lower extremities, while the patient retains full use of his arms and is perfectly conscious, sometimes reading a newspaper or listening to a radio while the operation is in progress.

DURING the past three and a balf years, one Brooklyn, N. Y., surgeon has performed more than 3,500 operations using this type of anesthetic with remarkable success. It eliminates nauses after the operation and there is no excitement stage as there is with

It was in Brooklyn that one of the queerest happenings ever reported from an operating room occurred recently when a patient on the operating table sounded a fire alarm? He was looking out the window when he saw flames in another wing of the building. A waste basket had caught on fire. His quick warning resulted in speedy work that kept the blaze from spreading.

Two new anesthetics which have been introduced only recently are avertin and pernocton. Avertin is given by rectal injection
and is particularly useful for short operations. It acts quickly and the effects are all
over in an hour, Pernocton is taken by mouth
or injected into the veins. It puts the patient
into a deep sleep which lasts for several hours,
during which time a major operation can be
performed.

Avertin was the anesthetic used with remarkable success in the recent operation upon Henry Ford, the famous automobile manufacturer, in Detroit. Because it imposes a minimum of strain upon the heart, the new drug was selected by Dr. Roy D. McClure, Head of the Ford Hospital and the surgeon who performed the operation for appendicitis and strangulated hernia. After the operation, which required forty-minutes, the progress of the sixty-mine-year-old industrialist was highly satisfactory. In less than the usual time he was able to leave his bed.

Local anesthetics are now being used frequently in major operations, Novocaine (one-seventh as dangerous as cocaine), escaine, and henzyl alcohol are finding wide favor among surgeons. In shull surgery, local anesthetics are often employed in place of other. They deaden the skin and fiesh where the incision is made. After the bone is reached, there is no sensation of pain.

Not long ago, a Long Island physician was injured in an automobile crash. A bone splinter, an inch long and half an inch wide, had to be removed from the base of his brain. All during the operation, which lasted forty-five minutes, he retained consciousness, discussing the various steps of the work with the surgeon.

The most remarkable use of a local anesthetic in major surgery was the operation which Dr. Evan O'Neill Kane performed upon himself. This famous surgeon had operated upon nearly 4,000 appendictis cases when be himself, was attacked. Sitting on the operating table, propped up by jallows, he swabbed the right side of his abdomen with iodine and alcohol and then injected novocaine from a small hypodermic syringe along the line he intended to cut.

WITH a steady hand, he made the inclsion, removed the appendix, placed the pure-string stitch of catgut around the stump and pulled it inst. He was out of the hospital, following the operation, in less than the usual time. His experiment, he pointed out, demonstrated that when the system is not burdened with a general anesthetic recovery is hastened.

The newest local anesthetic is diothane, recently discovered by Dr. T. H. Rider and E. W. Scott, two Cincinnati, Ohio, chemists. It is said to deaden pain longer than either novocaine or cocaine and yet has no habit-forming properties. Because of the slowners with which the anesthetic disappears after an operation, it items the patient comfortable longer than is usually the case. The new drug is closely related to a number of similar organic anesthetics which are not particularly effective. The potency of diothane is said to be accounted for by a few slight changes in the position of the atoms in the chemical compound.

Eighty-seven years have passed since Morton demonstrated to the doctors of Boston the magic power of other fames. During those decades, medicine has traveled far on the road to painless surgery. The safety and effectiveness of anesthetics have increased many-fold. Month by month, surgeons report new feats which add fresh chapters to this thrilling story of conquering pain in the operating room.

NEXT MONTH Dr. Dameau will tell the amazing story of the human carpentry that takes place in the modern operating room. He tells of living bone grafted from one part of a patient's body to another; of severed arteries newed together; of paralytis cured by surgery. Watch for the March issue, out February 1.



Foley Electrakeen Lawn Mower Sharpener

Uses same system as the leading lawn mover factories. Sharpens all sizes and types of lawn movers, Costa you only it a job and you get \$1.00 to \$1.50. New attachment also grinds axes, hatchets, knives, etc., Walter Dambek writes, "I purchased a Foley Electrakeen Lawn Mover Sharpener three weeks ago and have already made mough money to pay for the machine and all expenses..."

Big Profits Can Be Earned

There is pleasy of leadings waiting for you, Passile would resher laws their laws movers sharp-mod the Tules was because they say bester and stay their parts of the say has been as a sart this hustines in space time and make 1913 MONEY! Book! Investment—test smoothly parameter for high will save be been former will be loss of business for kep—Send makeson of parameters, business for kep—Send makeson of parameters to as a sense to be a sense of the same to



Foley Manufacturing Co.

200-3 Foley Bidg., 11 Moin 62. R. C., Minneapolite, Minn.

Tell you have I can start our own Cash Distinces and
grate Big Fredex with the Foley Electration Laws

Address Plate	Name	
	L-Sdrame	
	A STATE OF THE STA	5.1



New Ideas now Salable Before Patenting

Have you a sound, practical invention for sale, unpatented or patented? If so, write Curtered Institute of American Investors see Barrister Building Washington, D. C. "World's Largest Organization of Inventors"

Transatlantic Air Line Links Two Continents

(Continued from page 15)

floodlights at the airport at Cadiz, eighty miles up the Atlantic coast from Gibraltar, fourteen hours after the takeoff in Berlin.

There the Bathurst plane is warmed up for its 1,800-mile dash southward across Africa. Leaving at surrise, it sweeps down the Spanish coast, out over the Rock of Gibraltar and the narrow entrance to the Meditervanean, and begins the lonely flight across mountainous Morocco and the wastes of the western Sahara. All day long, hour after hour, it rushes through the sky above desert sand, rolling and monotonous. Toward evening, the Senegal River winds across its path. Tangled jungles are now below. Three hours later, the lights of Bathurst appear in the dusk. The plane slips down with throttled motors to a landing on the floodlighted field. It has been in the air eighteen hours in one stretch.

FOR the ocean leg of the journey, winged boats produced by the jamous Dornier factory are used exclusively. The first machines put in service will be twin-engined Dornier "Whales." Later, it is planned to substitute giant twelve-engined DO-X models, fitted with special staterooms and Pullman beds for passengers.

The twin-engined machines have the motors placed in tandem above the high monoplane wing, one pushing, the other pulling. In the hull, below the wing, immense gasoline tanks hold sufficient fuel to drive the two 400-horse-power engines for nearly fourteen hours. With throttles wide open, the Whales will rush through the air at more than two miles a minute.

Both on tropical aleways and in northern Siberia, these sturdy machines have demonstrated their endurance. A remarkable example is the old Dornier-Wal, Dt422, which recently was retired from service and placed on exhibit in the museum of Munich, Ger-

It began its career in 1925 above the Arctic ice when Roald Amundsen and Lincoln Ellsworth tried to fly to the North Pole. Two years later, Capt. Frank T. Courtney, the British war ace and test pilot, used it in an attempt to fly the Atlantic from east to west, starting from the Azores. Finally, in 1930, the veteran of the air carried Wolfgang von Gronau and his companions on their pioneer flight from Germany to America, in which they followed the trail of the Norsemen, flying by way of Iceland, Greenland and Labrador. After seven years of exploring uncharted skyways, D1422 was still flying when it was retired from service.

Before daylight the next morning, the Dornier is packed with mail and express, ready for the takeoff. At the nose of the long hull, the pilot sits behind a control wheel. In front of the cockpit is an empty anti-collision chamber to reduce the hazards of a head-on smash. Just back of the pilot is the radio room. Here the operator, with his 2,500-mile short-wave transmitter, and his receiving set, will keep in touch with the shore and the Westfalen during the flight. Back of the radio room is the mail and express compartment and back of it a storage space for extra gasoline supply and motor oil.

WITH idling engines, the plane swings slowly out to sea. The pilot opens the throttles. His speed increases. There is a flash of spray, a disaying rush of water and the craft is in the air. The ocean drops away. Rapidly, the coast line recedes into the morning mist. The plane is over the sea heading for a tiny 400-foot island floating in midocean, nearly a thousand mikes away!

On the top of the white hull is something looking like a barrel hoop standing unright

and pointing straight ahead. It is the loop antenna of the radio compass. Like a bloodhound's nose, it will lead to the goal, for lowing the radio waves coming from the Westfalen.

The strength of the signals received depends upon the position of the loop, which can be moved on a vertical axis. When it is edgewise to the direction from which the signals come, the volume is greatest; when the opening of the loop (aces the direction of source, the volume is least. By adjusting the loop to keep the signals at their maximum volume, the radio operator guides the boat through the sky to its moving larget.

This route over the ocean will slice across the Equator from twelve degrees north, the position of Bathurst, to eight degrees south, the position of Pernambuco. From time to time, the radio man passes up weather reports. All are invorable. Only small

From time to time, the radio man passes up weather reports. All are invorable. Only small tropical showers, that pound on the seventyfour-foot wings and the hull of the boat for a few minutes and then are gone, break the monotony of the flight.

A little after noon, the pilot sees far in the distance, a toy ship training a faint black thread of smoke. Behind it, appears a tiny white blotch. It is the B'estfoles with the drag sail ready. The vessel is beading into the wind. The plane comes down in a long slant, skims over the water, slows down in a cloud of spray, and slides up on the canvas without a jar. Mechanics, clambering on the wing, attach the hoisting cable and it is pulled slowly to the deck. The first half of the sea flight

Less than half an bour later the Dornier

Rest Chair for Movie Stars



Movie stars must rest between scenes despite tight gowns that can't be sot down in without disaster. This ingenious rest chair is the solution of the problem is refueled, tuned up, and on the launching rails of the great catapult. Before a row of gages the man in charge of the 150-foot airgun stands ready. With racing engines, the pilot signals for the start. An instant later the big plane whizzes down the steel track as though shot from a giant sling. One breath-taking rush and it is in the air, In five minutes the Westfales is again a toy ship.

A little after two in the afternoon the craft passes the Equator. From then on until dusk it plows straight ahead for the Brazilian coast. Near sunset it passes three or four vessels steaming slowly across the water below. But darkness falls before the idend of Fernando Noronka, the first point of land met on the westward passage is sighted. It is nine o'clock when the cluster of lights marking Pernambuco appears dead ahead and the palot dips downward and plows to a stop in the bay. He has crossed the Atlantic in slightly more than eighteen hours. By catching the night plane for the south, passengers can reach Rio de Janeiro by mid-morning and complete the 6,000-mile air journey from the capital of Germany to the capital of Brazil in less than three days.

THE trip is the reverse direction, crossing the Atlantic from west to east, takes from half a day to a day longer. Near the Equator, where the ocean crossing is made, trade winds blow steadily from the east, speeding up planes flying west and slowing them down flying east. This is exactly the reverse of conditions over the North Atlantic.

The first pilots who bridged the South Atlantic on wings all made the westward penage to get full advantage of steady tall winds.

It is interesting to note that the first machine to blaze an air trail from Europe to South America was an early model of the Dornier-Wal, the type of ship to be employed on the new airway. In 1926, Capt. Ramon Franco and three companions flew from Spain to Buenos Aires, taking two weeks for the journey and making frequent stops. The takeoff of the historic flight was made from the very bay of Huelva out of which Christopher Columbus, 434 years before, had sailed in his Santa Maria on his voyage to the New World.

The first non-stop crossing came in October 1927, five months after Lindbergh's dash to Paris. With one companion, the famous French Syer, Capt. Dieudonne Costes, left St. Louis, Senegal, Africa, and headed his Breguet land plane southwest over the Atlantic, landing aimeteen hours and twenty minutes later at Natal, Brazil.

In the two years after Costes' exploit three pilots flew non-stop from Europe to South America. Two started from Seville, Spain, while the third, Major Carlo del Prete, took off from Rome, Italy, remained in the air fifty-one bours and fifty-nine minutes, and covered 4,450 miles before he brought his record-breaking monoplane to earth at Natal.

The most careful survey of conditions over the ocean airway between Africa and South America was made during the past two years by the Grof Zeppeün. Under the direction of Lufthunsa officials this famous German dirigible made ten round trips between Friedrichshafen and Brazil. During the previous summer it had crossed the South Atlantic six times.

From these pioneering flights information was gathered which will be of value to the daring men who lead the way on a regularly-scheduled transatlantic air service. When the Santo Maris of this service, the first Dornier-Wal, takes off and heads out to sea, it will mark an important step toward dramatic possibilities which lie ahead.





"It's toasted"